

Service Manual



Vector Network Analyzers

R&S[®] ZVB 4 / ZVB 8 / ZVB 14 / ZVB 20

1145.1010.04/06 / 08/10 / 14/17/19 / 20/23/25

R&S® is a registered trademark of Rohde & Schwarz GmbH & Co. KG.
Trade names are trademarks of the owners.

The instrument includes software developed by the OpenSSL Project for use in the OpenSSL Toolkit (<http://www.openssl.org/>). It includes cryptographic software written by Eric Young (eay@cryptsoft.com) and software written by Tim Hudson (tjh@cryptsoft.com). The verbatim license texts are provided in on the user documentation CD-ROM (included in delivery).

Basic Safety Instructions

Always read through and comply with the following safety instructions!

All plants and locations of the Rohde & Schwarz group of companies make every effort to keep the safety standards of our products up to date and to offer our customers the highest possible degree of safety. Our products and the auxiliary equipment they require are designed, built and tested in accordance with the safety standards that apply in each case. Compliance with these standards is continuously monitored by our quality assurance system. The product described here has been designed, built and tested in accordance with the EC Certificate of Conformity and has left the manufacturer's plant in a condition fully complying with safety standards. To maintain this condition and to ensure safe operation, you must observe all instructions and warnings provided in this manual. If you have any questions regarding these safety instructions, the Rohde & Schwarz group of companies will be happy to answer them.

Furthermore, it is your responsibility to use the product in an appropriate manner. This product is designed for use solely in industrial and laboratory environments or, if expressly permitted, also in the field and must not be used in any way that may cause personal injury or property damage. You are responsible if the product is used for any purpose other than its designated purpose or in disregard of the manufacturer's instructions. The manufacturer shall assume no responsibility for such use of the product.

The product is used for its designated purpose if it is used in accordance with its product documentation and within its performance limits (see data sheet, documentation, the following safety instructions). Using the product requires technical skills and, in some cases, a basic knowledge of English. It is therefore essential that only skilled and specialized staff or thoroughly trained personnel with the required skills be allowed to use the product. If personal safety gear is required for using Rohde & Schwarz products, this will be indicated at the appropriate place in the product documentation. Keep the basic safety instructions and the product documentation in a safe place and pass them on to the subsequent users.

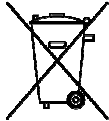
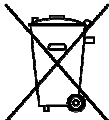
Observing the safety instructions will help prevent personal injury or damage of any kind caused by dangerous situations. Therefore, carefully read through and adhere to the following safety instructions before and when using the product. It is also absolutely essential to observe the additional safety instructions on personal safety, for example, that appear in relevant parts of the product documentation. In these safety instructions, the word "product" refers to all merchandise sold and distributed by the Rohde & Schwarz group of companies, including instruments, systems and all accessories. For product-specific information, see the data sheet and the product documentation.

Safety labels on products

The following safety labels are used on products to warn against risks and dangers.

Symbol	Meaning	Symbol	Meaning
	Notice, general danger location Observe product documentation	○	ON/OFF supply voltage
	Caution when handling heavy equipment	⏻	Standby indication
	Danger of electric shock	— — —	Direct current (DC)

Basic Safety Instructions

Symbol	Meaning	Symbol	Meaning
	Warning! Hot surface		Alternating current (AC)
	Protective conductor terminal		Direct/alternating current (DC/AC)
	Ground		Device fully protected by double (reinforced) insulation
	Ground terminal		EU labeling for batteries and accumulators For additional information, see section "Waste disposal/Environmental protection", item 1.
	Be careful when handling electrostatic sensitive devices		EU labeling for separate collection of electrical and electronic devices For additional information, see section "Waste disposal/Environmental protection", item 2.
	Warning! Laser radiation For additional information, see section "Operation", item 7.		

Signal words and their meaning

The following signal words are used in the product documentation in order to warn the reader about risks and dangers.



Indicates a hazardous situation which, if not avoided, will result in death or serious injury.



Indicates a hazardous situation which, if not avoided, could result in death or serious injury.



Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.



Indicates information considered important, but not hazard-related, e.g. messages relating to property damage.
In the product documentation, the word ATTENTION is used synonymously.

These signal words are in accordance with the standard definition for civil applications in the European Economic Area. Definitions that deviate from the standard definition may also exist in other economic areas or military applications. It is therefore essential to make sure that the signal words described here are always used only in connection with the related product documentation and the related product. The use of signal words in connection with unrelated products or documentation can result in misinterpretation and in personal injury or material damage.

Basic Safety Instructions

Operating states and operating positions

The product may be operated only under the operating conditions and in the positions specified by the manufacturer, without the product's ventilation being obstructed. If the manufacturer's specifications are not observed, this can result in electric shock, fire and/or serious personal injury or death. Applicable local or national safety regulations and rules for the prevention of accidents must be observed in all work performed.

1. Unless otherwise specified, the following requirements apply to Rohde & Schwarz products: predefined operating position is always with the housing floor facing down, IP protection 2X, use only indoors, max. operating altitude 2000 m above sea level, max. transport altitude 4500 m above sea level. A tolerance of $\pm 10\%$ shall apply to the nominal voltage and $\pm 5\%$ to the nominal frequency, overvoltage category 2, pollution severity 2.
2. Do not place the product on surfaces, vehicles, cabinets or tables that for reasons of weight or stability are unsuitable for this purpose. Always follow the manufacturer's installation instructions when installing the product and fastening it to objects or structures (e.g. walls and shelves). An installation that is not carried out as described in the product documentation could result in personal injury or even death.
3. Do not place the product on heat-generating devices such as radiators or fan heaters. The ambient temperature must not exceed the maximum temperature specified in the product documentation or in the data sheet. Product overheating can cause electric shock, fire and/or serious personal injury or even death.

Electrical safety

If the information on electrical safety is not observed either at all or to the extent necessary, electric shock, fire and/or serious personal injury or death may occur.

1. Prior to switching on the product, always ensure that the nominal voltage setting on the product matches the nominal voltage of the AC supply network. If a different voltage is to be set, the power fuse of the product may have to be changed accordingly.
2. In the case of products of safety class I with movable power cord and connector, operation is permitted only on sockets with a protective conductor contact and protective conductor.
3. Intentionally breaking the protective conductor either in the feed line or in the product itself is not permitted. Doing so can result in the danger of an electric shock from the product. If extension cords or connector strips are implemented, they must be checked on a regular basis to ensure that they are safe to use.
4. If there is no power switch for disconnecting the product from the AC supply network, or if the power switch is not suitable for this purpose, use the plug of the connecting cable to disconnect the product from the AC supply network. In such cases, always ensure that the power plug is easily reachable and accessible at all times. For example, if the power plug is the disconnecting device, the length of the connecting cable must not exceed 3 m. Functional or electronic switches are not suitable for providing disconnection from the AC supply network. If products without power switches are integrated into racks or systems, the disconnecting device must be provided at the system level.
5. Never use the product if the power cable is damaged. Check the power cables on a regular basis to ensure that they are in proper operating condition. By taking appropriate safety measures and carefully laying the power cable, ensure that the cable cannot be damaged and that no one can be hurt by, for example, tripping over the cable or suffering an electric shock.

Basic Safety Instructions

6. The product may be operated only from TN/TT supply networks fuse-protected with max. 16 A (higher fuse only after consulting with the Rohde & Schwarz group of companies).
7. Do not insert the plug into sockets that are dusty or dirty. Insert the plug firmly and all the way into the socket provided for this purpose. Otherwise, sparks that result in fire and/or injuries may occur.
8. Do not overload any sockets, extension cords or connector strips; doing so can cause fire or electric shocks.
9. For measurements in circuits with voltages $V_{rms} > 30$ V, suitable measures (e.g. appropriate measuring equipment, fuse protection, current limiting, electrical separation, insulation) should be taken to avoid any hazards.
10. Ensure that the connections with information technology equipment, e.g. PCs or other industrial computers, comply with the IEC60950-1/EN60950-1 or IEC61010-1/EN 61010-1 standards that apply in each case.
11. Unless expressly permitted, never remove the cover or any part of the housing while the product is in operation. Doing so will expose circuits and components and can lead to injuries, fire or damage to the product.
12. If a product is to be permanently installed, the connection between the protective conductor terminal on site and the product's protective conductor must be made first before any other connection is made. The product may be installed and connected only by a licensed electrician.
13. For permanently installed equipment without built-in fuses, circuit breakers or similar protective devices, the supply circuit must be fuse-protected in such a way that anyone who has access to the product, as well as the product itself, is adequately protected from injury or damage.
14. Use suitable overvoltage protection to ensure that no overvoltage (such as that caused by a bolt of lightning) can reach the product. Otherwise, the person operating the product will be exposed to the danger of an electric shock.
15. Any object that is not designed to be placed in the openings of the housing must not be used for this purpose. Doing so can cause short circuits inside the product and/or electric shocks, fire or injuries.
16. Unless specified otherwise, products are not liquid-proof (see also section "Operating states and operating positions", item 1). Therefore, the equipment must be protected against penetration by liquids. If the necessary precautions are not taken, the user may suffer electric shock or the product itself may be damaged, which can also lead to personal injury.
17. Never use the product under conditions in which condensation has formed or can form in or on the product, e.g. if the product has been moved from a cold to a warm environment. Penetration by water increases the risk of electric shock.
18. Prior to cleaning the product, disconnect it completely from the power supply (e.g. AC supply network or battery). Use a soft, non-linting cloth to clean the product. Never use chemical cleaning agents such as alcohol, acetone or diluents for cellulose lacquers.

Operation

1. Operating the products requires special training and intense concentration. Make sure that persons who use the products are physically, mentally and emotionally fit enough to do so; otherwise, injuries or material damage may occur. It is the responsibility of the employer/operator to select suitable personnel for operating the products.

Basic Safety Instructions

2. Before you move or transport the product, read and observe the section titled "Transport".
3. As with all industrially manufactured goods, the use of substances that induce an allergic reaction (allergens) such as nickel cannot be generally excluded. If you develop an allergic reaction (such as a skin rash, frequent sneezing, red eyes or respiratory difficulties) when using a Rohde & Schwarz product, consult a physician immediately to determine the cause and to prevent health problems or stress.
4. Before you start processing the product mechanically and/or thermally, or before you take it apart, be sure to read and pay special attention to the section titled "Waste disposal/Environmental protection", item 1.
5. Depending on the function, certain products such as RF radio equipment can produce an elevated level of electromagnetic radiation. Considering that unborn babies require increased protection, pregnant women must be protected by appropriate measures. Persons with pacemakers may also be exposed to risks from electromagnetic radiation. The employer/operator must evaluate workplaces where there is a special risk of exposure to radiation and, if necessary, take measures to avert the potential danger.
6. Should a fire occur, the product may release hazardous substances (gases, fluids, etc.) that can cause health problems. Therefore, suitable measures must be taken, e.g. protective masks and protective clothing must be worn.
7. Laser products are given warning labels that are standardized according to their laser class. Lasers can cause biological harm due to the properties of their radiation and due to their extremely concentrated electromagnetic power. If a laser product (e.g. a CD/DVD drive) is integrated into a Rohde & Schwarz product, absolutely no other settings or functions may be used as described in the product documentation. The objective is to prevent personal injury (e.g. due to laser beams).
8. EMC classes (in line with EN 55011/CISPR 11, and analogously with EN 55022/CISPR 22, EN 55032/CISPR 32)
 - Class A equipment:
Equipment suitable for use in all environments except residential environments and environments that are directly connected to a low-voltage supply network that supplies residential buildings
Note: Class A equipment is intended for use in an industrial environment. This equipment may cause radio disturbances in residential environments, due to possible conducted as well as radiated disturbances. In this case, the operator may be required to take appropriate measures to eliminate these disturbances.
 - Class B equipment:
Equipment suitable for use in residential environments and environments that are directly connected to a low-voltage supply network that supplies residential buildings

Repair and service

1. The product may be opened only by authorized, specially trained personnel. Before any work is performed on the product or before the product is opened, it must be disconnected from the AC supply network. Otherwise, personnel will be exposed to the risk of an electric shock.

Basic Safety Instructions

2. Adjustments, replacement of parts, maintenance and repair may be performed only by electrical experts authorized by Rohde & Schwarz. Only original parts may be used for replacing parts relevant to safety (e.g. power switches, power transformers, fuses). A safety test must always be performed after parts relevant to safety have been replaced (visual inspection, protective conductor test, insulation resistance measurement, leakage current measurement, functional test). This helps ensure the continued safety of the product.

Batteries and rechargeable batteries/cells

If the information regarding batteries and rechargeable batteries/cells is not observed either at all or to the extent necessary, product users may be exposed to the risk of explosions, fire and/or serious personal injury, and, in some cases, death. Batteries and rechargeable batteries with alkaline electrolytes (e.g. lithium cells) must be handled in accordance with the EN 62133 standard.

1. Cells must not be taken apart or crushed.
2. Cells or batteries must not be exposed to heat or fire. Storage in direct sunlight must be avoided. Keep cells and batteries clean and dry. Clean soiled connectors using a dry, clean cloth.
3. Cells or batteries must not be short-circuited. Cells or batteries must not be stored in a box or in a drawer where they can short-circuit each other, or where they can be short-circuited by other conductive materials. Cells and batteries must not be removed from their original packaging until they are ready to be used.
4. Cells and batteries must not be exposed to any mechanical shocks that are stronger than permitted.
5. If a cell develops a leak, the fluid must not be allowed to come into contact with the skin or eyes. If contact occurs, wash the affected area with plenty of water and seek medical aid.
6. Improperly replacing or charging cells or batteries that contain alkaline electrolytes (e.g. lithium cells) can cause explosions. Replace cells or batteries only with the matching Rohde & Schwarz type (see parts list) in order to ensure the safety of the product.
7. Cells and batteries must be recycled and kept separate from residual waste. Rechargeable batteries and normal batteries that contain lead, mercury or cadmium are hazardous waste. Observe the national regulations regarding waste disposal and recycling.

Transport

1. The product may be very heavy. Therefore, the product must be handled with care. In some cases, the user may require a suitable means of lifting or moving the product (e.g. with a lift-truck) to avoid back or other physical injuries.
2. Handles on the products are designed exclusively to enable personnel to transport the product. It is therefore not permissible to use handles to fasten the product to or on transport equipment such as cranes, fork lifts, wagons, etc. The user is responsible for securely fastening the products to or on the means of transport or lifting. Observe the safety regulations of the manufacturer of the means of transport or lifting. Noncompliance can result in personal injury or material damage.
3. If you use the product in a vehicle, it is the sole responsibility of the driver to drive the vehicle safely and properly. The manufacturer assumes no responsibility for accidents or collisions. Never use the product in a moving vehicle if doing so could distract the driver of the vehicle. Adequately secure the product in the vehicle to prevent injuries or other damage in the event of an accident.

Instrucciones de seguridad elementales

Waste disposal/Environmental protection

1. Specially marked equipment has a battery or accumulator that must not be disposed of with unsorted municipal waste, but must be collected separately. It may only be disposed of at a suitable collection point or via a Rohde & Schwarz customer service center.
2. Waste electrical and electronic equipment must not be disposed of with unsorted municipal waste, but must be collected separately.
Rohde & Schwarz GmbH & Co. KG has developed a disposal concept and takes full responsibility for take-back obligations and disposal obligations for manufacturers within the EU. Contact your Rohde & Schwarz customer service center for environmentally responsible disposal of the product.
3. If products or their components are mechanically and/or thermally processed in a manner that goes beyond their intended use, hazardous substances (heavy-metal dust such as lead, beryllium, nickel) may be released. For this reason, the product may only be disassembled by specially trained personnel. Improper disassembly may be hazardous to your health. National waste disposal regulations must be observed.
4. If handling the product releases hazardous substances or fuels that must be disposed of in a special way, e.g. coolants or engine oils that must be replenished regularly, the safety instructions of the manufacturer of the hazardous substances or fuels and the applicable regional waste disposal regulations must be observed. Also observe the relevant safety instructions in the product documentation. The improper disposal of hazardous substances or fuels can cause health problems and lead to environmental damage.

For additional information about environmental protection, visit the Rohde & Schwarz website.

Instrucciones de seguridad elementales

¡Es imprescindible leer y cumplir las siguientes instrucciones e informaciones de seguridad!

El principio del grupo de empresas Rohde & Schwarz consiste en tener nuestros productos siempre al día con los estándares de seguridad y de ofrecer a nuestros clientes el máximo grado de seguridad. Nuestros productos y todos los equipos adicionales son siempre fabricados y examinados según las normas de seguridad vigentes. Nuestro sistema de garantía de calidad controla constantemente que sean cumplidas estas normas. El presente producto ha sido fabricado y examinado según el certificado de conformidad de la UE y ha salido de nuestra planta en estado impecable según los estándares técnicos de seguridad. Para poder preservar este estado y garantizar un funcionamiento libre de peligros, el usuario deberá atenerse a todas las indicaciones, informaciones de seguridad y notas de alerta. El grupo de empresas Rohde & Schwarz está siempre a su disposición en caso de que tengan preguntas referentes a estas informaciones de seguridad.

Además queda en la responsabilidad del usuario utilizar el producto en la forma debida. Este producto está destinado exclusivamente al uso en la industria y el laboratorio o, si ha sido expresamente autorizado, para aplicaciones de campo y de ninguna manera deberá ser utilizado de modo que alguna persona/cosa pueda sufrir daño. El uso del producto fuera de sus fines definidos o sin tener en cuenta las instrucciones del fabricante queda en la responsabilidad del usuario. El fabricante no se hace en ninguna forma responsable de consecuencias a causa del mal uso del producto.

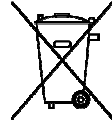
Instrucciones de seguridad elementales

Se parte del uso correcto del producto para los fines definidos si el producto es utilizado conforme a las indicaciones de la correspondiente documentación del producto y dentro del margen de rendimiento definido (ver hoja de datos, documentación, informaciones de seguridad que siguen). El uso del producto hace necesarios conocimientos técnicos y ciertos conocimientos del idioma inglés. Por eso se debe tener en cuenta que el producto solo pueda ser operado por personal especializado o personas instruidas en profundidad con las capacidades correspondientes. Si fuera necesaria indumentaria de seguridad para el uso de productos de Rohde & Schwarz, encontraría la información debida en la documentación del producto en el capítulo correspondiente. Guarde bien las informaciones de seguridad elementales, así como la documentación del producto, y entréguelas a usuarios posteriores.

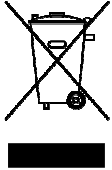
Tener en cuenta las informaciones de seguridad sirve para evitar en lo posible lesiones o daños por peligros de toda clase. Por eso es imprescindible leer detalladamente y comprender por completo las siguientes informaciones de seguridad antes de usar el producto, y respetarlas durante el uso del producto. Deberán tenerse en cuenta todas las demás informaciones de seguridad, como p. ej. las referentes a la protección de personas, que encontrarán en el capítulo correspondiente de la documentación del producto y que también son de obligado cumplimiento. En las presentes informaciones de seguridad se recogen todos los objetos que distribuye el grupo de empresas Rohde & Schwarz bajo la denominación de "producto", entre ellos también aparatos, instalaciones así como toda clase de accesorios. Los datos específicos del producto figuran en la hoja de datos y en la documentación del producto.

Señalización de seguridad de los productos

Las siguientes señales de seguridad se utilizan en los productos para advertir sobre riesgos y peligros.

Símbolo	Significado	Símbolo	Significado
	Aviso: punto de peligro general Observar la documentación del producto		Tensión de alimentación de PUESTA EN MARCHA / PARADA
	Atención en el manejo de dispositivos de peso elevado		Indicación de estado de espera (standby)
	Peligro de choque eléctrico		Corriente continua (DC)
	Advertencia: superficie caliente		Corriente alterna (AC)
	Conexión a conductor de protección		Corriente continua / Corriente alterna (DC/AC)
	Conexión a tierra		El aparato está protegido en su totalidad por un aislamiento doble (reforzado)
	Conexión a masa		Distintivo de la UE para baterías y acumuladores Más información en la sección "Eliminación/protección del medio ambiente", punto 1.

Instrucciones de seguridad elementales

Símbolo	Significado	Símbolo	Significado
	Aviso: Cuidado en el manejo de dispositivos sensibles a la electrostática (ESD)		Distintivo de la UE para la eliminación por separado de dispositivos eléctricos y electrónicos Más información en la sección "Eliminación/protección del medio ambiente", punto 2.
	Advertencia: rayo láser Más información en la sección "Funcionamiento", punto 7.		

Palabras de señal y su significado

En la documentación del producto se utilizan las siguientes palabras de señal con el fin de advertir contra riesgos y peligros.



Indica una situación de peligro que, si no se evita, causa lesiones graves o incluso la muerte.



Indica una situación de peligro que, si no se evita, puede causar lesiones graves o incluso la muerte.



Indica una situación de peligro que, si no se evita, puede causar lesiones leves o moderadas.



Indica información que se considera importante, pero no en relación con situaciones de peligro; p. ej., avisos sobre posibles daños materiales.

En la documentación del producto se emplea de forma sinónima el término CUIDADO.

Las palabras de señal corresponden a la definición habitual para aplicaciones civiles en el área económica europea. Pueden existir definiciones diferentes a esta definición en otras áreas económicas o en aplicaciones militares. Por eso se deberá tener en cuenta que las palabras de señal aquí descritas sean utilizadas siempre solamente en combinación con la correspondiente documentación del producto y solamente en combinación con el producto correspondiente. La utilización de las palabras de señal en combinación con productos o documentaciones que no les correspondan puede llevar a interpretaciones equivocadas y tener por consecuencia daños en personas u objetos.

Estados operativos y posiciones de funcionamiento

El producto solamente debe ser utilizado según lo indicado por el fabricante respecto a los estados operativos y posiciones de funcionamiento sin que se obstruya la ventilación. Si no se siguen las indicaciones del fabricante, pueden producirse choques eléctricos, incendios y/o lesiones graves con posible consecuencia de muerte. En todos los trabajos deberán ser tenidas en cuenta las normas nacionales y locales de seguridad del trabajo y de prevención de accidentes.

Instrucciones de seguridad elementales

1. Si no se convino de otra manera, es para los productos Rohde & Schwarz válido lo que sigue: como posición de funcionamiento se define por principio la posición con el suelo de la caja para abajo, modo de protección IP 2X, uso solamente en estancias interiores, utilización hasta 2000 m sobre el nivel del mar, transporte hasta 4500 m sobre el nivel del mar. Se aplicará una tolerancia de $\pm 10\%$ sobre el voltaje nominal y de $\pm 5\%$ sobre la frecuencia nominal. Categoría de sobrecarga eléctrica 2, índice de suciedad 2.
2. No sitúe el producto encima de superficies, vehículos, estantes o mesas, que por sus características de peso o de estabilidad no sean aptos para él. Siga siempre las instrucciones de instalación del fabricante cuando instale y asegure el producto en objetos o estructuras (p. ej. paredes y estantes). Si se realiza la instalación de modo distinto al indicado en la documentación del producto, se pueden causar lesiones o, en determinadas circunstancias, incluso la muerte.
3. No ponga el producto sobre aparatos que generen calor (p. ej. radiadores o calefactores). La temperatura ambiente no debe superar la temperatura máxima especificada en la documentación del producto o en la hoja de datos. En caso de sobrecalentamiento del producto, pueden producirse choques eléctricos, incendios y/o lesiones graves con posible consecuencia de muerte.

Seguridad eléctrica

Si no se siguen (o se siguen de modo insuficiente) las indicaciones del fabricante en cuanto a seguridad eléctrica, pueden producirse choques eléctricos, incendios y/o lesiones graves con posible consecuencia de muerte.

1. Antes de la puesta en marcha del producto se deberá comprobar siempre que la tensión preseleccionada en el producto coincida con la de la red de alimentación eléctrica. Si es necesario modificar el ajuste de tensión, también se deberán cambiar en caso dado los fusibles correspondientes del producto.
2. Los productos de la clase de protección I con alimentación móvil y enchufe individual solamente podrán enchufarse a tomas de corriente con contacto de seguridad y con conductor de protección conectado.
3. Queda prohibida la interrupción intencionada del conductor de protección, tanto en la toma de corriente como en el mismo producto. La interrupción puede tener como consecuencia el riesgo de que el producto sea fuente de choques eléctricos. Si se utilizan cables alargadores o regletas de enchufe, deberá garantizarse la realización de un examen regular de los mismos en cuanto a su estado técnico de seguridad.
4. Si el producto no está equipado con un interruptor para desconectarlo de la red, o bien si el interruptor existente no resulta apropiado para la desconexión de la red, el enchufe del cable de conexión se deberá considerar como un dispositivo de desconexión. El dispositivo de desconexión se debe poder alcanzar fácilmente y debe estar siempre bien accesible. Si, p. ej., el enchufe de conexión a la red es el dispositivo de desconexión, la longitud del cable de conexión no debe superar 3 m). Los interruptores selectores o electrónicos no son aptos para el corte de la red eléctrica. Si se integran productos sin interruptor en bastidores o instalaciones, se deberá colocar el interruptor en el nivel de la instalación.
5. No utilice nunca el producto si está dañado el cable de conexión a red. Compruebe regularmente el correcto estado de los cables de conexión a red. Asegúrese, mediante las medidas de protección y de instalación adecuadas, de que el cable de conexión a red no pueda ser dañado o de que nadie pueda ser dañado por él, p. ej. al tropezar o por un choque eléctrico.

Instrucciones de seguridad elementales

6. Solamente está permitido el funcionamiento en redes de alimentación TN/TT aseguradas con fusibles de 16 A como máximo (utilización de fusibles de mayor amperaje solo previa consulta con el grupo de empresas Rohde & Schwarz).
7. Nunca conecte el enchufe en tomas de corriente sucias o llenas de polvo. Introduzca el enchufe por completo y fuertemente en la toma de corriente. La no observación de estas medidas puede provocar chispas, fuego y/o lesiones.
8. No sobrecargue las tomas de corriente, los cables alargadores o las regletas de enchufe ya que esto podría causar fuego o choques eléctricos.
9. En las mediciones en circuitos de corriente con una tensión $U_{\text{eff}} > 30 \text{ V}$ se deberán tomar las medidas apropiadas para impedir cualquier peligro (p. ej. medios de medición adecuados, seguros, limitación de tensión, corte protector, aislamiento etc.).
10. Para la conexión con dispositivos informáticos como un PC o un ordenador industrial, debe comprobarse que éstos cumplan los estándares IEC60950-1/EN60950-1 o IEC61010-1/EN 61010-1 válidos en cada caso.
11. A menos que esté permitido expresamente, no retire nunca la tapa ni componentes de la carcasa mientras el producto esté en servicio. Esto pone a descubierto los cables y componentes eléctricos y puede causar lesiones, fuego o daños en el producto.
12. Si un producto se instala en un lugar fijo, se deberá primero conectar el conductor de protección fijo con el conductor de protección del producto antes de hacer cualquier otra conexión. La instalación y la conexión deberán ser efectuadas por un electricista especializado.
13. En el caso de dispositivos fijos que no estén provistos de fusibles, interruptor automático ni otros mecanismos de seguridad similares, el circuito de alimentación debe estar protegido de modo que todas las personas que puedan acceder al producto, así como el producto mismo, estén a salvo de posibles daños.
14. Todo producto debe estar protegido contra sobretensión (debida p. ej. a una caída del rayo) mediante los correspondientes sistemas de protección. Si no, el personal que lo utilice quedará expuesto al peligro de choque eléctrico.
15. No debe introducirse en los orificios de la caja del aparato ningún objeto que no esté destinado a ello. Esto puede producir cortocircuitos en el producto y/o puede causar choques eléctricos, fuego o lesiones.
16. Salvo indicación contraria, los productos no están impermeabilizados (ver también el capítulo "Estados operativos y posiciones de funcionamiento", punto 1). Por eso es necesario tomar las medidas necesarias para evitar la entrada de líquidos. En caso contrario, existe peligro de choque eléctrico para el usuario o de daños en el producto, que también pueden redundar en peligro para las personas.
17. No utilice el producto en condiciones en las que pueda producirse o ya se hayan producido condensaciones sobre el producto o en el interior de éste, como p. ej. al desplazarlo de un lugar frío a otro caliente. La entrada de agua aumenta el riesgo de choque eléctrico.
18. Antes de la limpieza, desconecte por completo el producto de la alimentación de tensión (p. ej. red de alimentación o batería). Realice la limpieza de los aparatos con un paño suave, que no se deshilache. No utilice bajo ningún concepto productos de limpieza químicos como alcohol, acetona o diluyentes para lacas nitrocelulósicas.

Funcionamiento

1. El uso del producto requiere instrucciones especiales y una alta concentración durante el manejo. Debe asegurarse que las personas que manejen el producto estén a la altura de los requerimientos necesarios en cuanto a aptitudes físicas, psíquicas y emocionales, ya que de otra manera no se pueden excluir lesiones o daños de objetos. El empresario u operador es responsable de seleccionar el personal usuario apto para el manejo del producto.
2. Antes de desplazar o transportar el producto, lea y tenga en cuenta el capítulo "Transporte".
3. Como con todo producto de fabricación industrial no puede quedar excluida en general la posibilidad de que se produzcan alergias provocadas por algunos materiales empleados —los llamados alérgenos (p. ej. el níquel)—. Si durante el manejo de productos Rohde & Schwarz se producen reacciones alérgicas, como p. ej. irritaciones cutáneas, estornudos continuos, enrojecimiento de la conjuntiva o dificultades respiratorias, debe avisarse inmediatamente a un médico para investigar las causas y evitar cualquier molestia o daño a la salud.
4. Antes de la manipulación mecánica y/o térmica o el desmontaje del producto, debe tenerse en cuenta imprescindiblemente el capítulo "Eliminación/protección del medio ambiente", punto 1.
5. Ciertos productos, como p. ej. las instalaciones de radiocomunicación RF, pueden a causa de su función natural, emitir una radiación electromagnética aumentada. Deben tomarse todas las medidas necesarias para la protección de las mujeres embarazadas. También las personas con marcapasos pueden correr peligro a causa de la radiación electromagnética. El empresario/operador tiene la obligación de evaluar y señalizar las áreas de trabajo en las que exista un riesgo elevado de exposición a radiaciones.
6. Tenga en cuenta que en caso de incendio pueden desprenderse del producto sustancias tóxicas (gases, líquidos etc.) que pueden generar daños a la salud. Por eso, en caso de incendio deben usarse medidas adecuadas, como p. ej. máscaras antigás e indumentaria de protección.
7. Los productos con láser están provistos de indicaciones de advertencia normalizadas en función de la clase de láser del que se trate. Los rayos láser pueden provocar daños de tipo biológico a causa de las propiedades de su radiación y debido a su concentración extrema de potencia electromagnética. En caso de que un producto Rohde & Schwarz contenga un producto láser (p. ej. un lector de CD/DVD), no debe usarse ninguna otra configuración o función aparte de las descritas en la documentación del producto, a fin de evitar lesiones (p. ej. debidas a irradiación láser).
8. Clases de compatibilidad electromagnética (conforme a EN 55011 / CISPR 11; y en analogía con EN 55022 / CISPR 22, EN 55032 / CISPR 32)
 - Aparato de clase A:
Aparato adecuado para su uso en todos los entornos excepto en los residenciales y en aquellos conectados directamente a una red de distribución de baja tensión que suministra corriente a edificios residenciales.
Nota: Los aparatos de clase A están destinados al uso en entornos industriales. Estos aparatos pueden causar perturbaciones radioeléctricas en entornos residenciales debido a posibles perturbaciones guiadas o radiadas. En este caso, se le podrá solicitar al operador que tome las medidas adecuadas para eliminar estas perturbaciones.
 - Aparato de clase B:
Aparato adecuado para su uso en entornos residenciales, así como en aquellos conectados directamente a una red de distribución de baja tensión que suministra corriente a edificios residenciales.

Instrucciones de seguridad elementales

Reparación y mantenimiento

1. El producto solamente debe ser abierto por personal especializado con autorización para ello. Antes de manipular el producto o abrirlo, es obligatorio desconectarlo de la tensión de alimentación, para evitar toda posibilidad de choque eléctrico.
2. El ajuste, el cambio de partes, el mantenimiento y la reparación deberán ser efectuadas solamente por electricistas autorizados por Rohde & Schwarz. Si se reponen partes con importancia para los aspectos de seguridad (p. ej. el enchufe, los transformadores o los fusibles), solamente podrán ser sustituidos por partes originales. Después de cada cambio de partes relevantes para la seguridad deberá realizarse un control de seguridad (control a primera vista, control del conductor de protección, medición de resistencia de aislamiento, medición de la corriente de fuga, control de funcionamiento). Con esto queda garantizada la seguridad del producto.

Baterías y acumuladores o celdas

Si no se siguen (o se siguen de modo insuficiente) las indicaciones en cuanto a las baterías y acumuladores o celdas, pueden producirse explosiones, incendios y/o lesiones graves con posible consecuencia de muerte. El manejo de baterías y acumuladores con electrolitos alcalinos (p. ej. celdas de litio) debe seguir el estándar EN 62133.

1. No deben desmontarse, abrirse ni triturarse las celdas.
2. Las celdas o baterías no deben someterse a calor ni fuego. Debe evitarse el almacenamiento a la luz directa del sol. Las celdas y baterías deben mantenerse limpias y secas. Limpiar las conexiones sucias con un paño seco y limpio.
3. Las celdas o baterías no deben cortocircuitarse. Es peligroso almacenar las celdas o baterías en estuches o cajones en cuyo interior puedan cortocircuitarse por contacto recíproco o por contacto con otros materiales conductores. No deben extraerse las celdas o baterías de sus embalajes originales hasta el momento en que vayan a utilizarse.
4. Las celdas o baterías no deben someterse a impactos mecánicos fuertes indebidos.
5. En caso de falta de estanqueidad de una celda, el líquido vertido no debe entrar en contacto con la piel ni los ojos. Si se produce contacto, lavar con agua abundante la zona afectada y avisar a un médico.
6. En caso de cambio o recarga inadecuados, las celdas o baterías que contienen electrolitos alcalinos (p. ej. las celdas de litio) pueden explotar. Para garantizar la seguridad del producto, las celdas o baterías solo deben ser sustituidas por el tipo Rohde & Schwarz correspondiente (ver lista de recambios).
7. Las baterías y celdas deben reciclarse y no deben tirarse a la basura doméstica. Las baterías o acumuladores que contienen plomo, mercurio o cadmio deben tratarse como residuos especiales. Respete en esta relación las normas nacionales de eliminación y reciclaje.

Transporte

1. El producto puede tener un peso elevado. Por eso es necesario desplazarlo o transportarlo con precaución y, si es necesario, usando un sistema de elevación adecuado (p. ej. una carretilla elevadora), a fin de evitar lesiones en la espalda u otros daños personales.

Instrucciones de seguridad elementales

2. Las asas instaladas en los productos sirven solamente de ayuda para el transporte del producto por personas. Por eso no está permitido utilizar las asas para la sujeción en o sobre medios de transporte como p. ej. grúas, carretillas elevadoras de horquilla, carros etc. Es responsabilidad suya fijar los productos de manera segura a los medios de transporte o elevación. Para evitar daños personales o daños en el producto, siga las instrucciones de seguridad del fabricante del medio de transporte o elevación utilizado.
3. Si se utiliza el producto dentro de un vehículo, recae de manera exclusiva en el conductor la responsabilidad de conducir el vehículo de manera segura y adecuada. El fabricante no asumirá ninguna responsabilidad por accidentes o colisiones. No utilice nunca el producto dentro de un vehículo en movimiento si esto pudiera distraer al conductor. Asegure el producto dentro del vehículo debidamente para evitar, en caso de un accidente, lesiones u otra clase de daños.

Eliminación/protección del medio ambiente

1. Los dispositivos marcados contienen una batería o un acumulador que no se debe desechar con los residuos domésticos sin clasificar, sino que debe ser recogido por separado. La eliminación se debe efectuar exclusivamente a través de un punto de recogida apropiado o del servicio de atención al cliente de Rohde & Schwarz.
2. Los dispositivos eléctricos usados no se deben desechar con los residuos domésticos sin clasificar, sino que deben ser recogidos por separado.
Rohde & Schwarz GmbH & Co.KG ha elaborado un concepto de eliminación de residuos y asume plenamente los deberes de recogida y eliminación para los fabricantes dentro de la UE. Para desechar el producto de manera respetuosa con el medio ambiente, dirijase a su servicio de atención al cliente de Rohde & Schwarz.
3. Si se trabaja de manera mecánica y/o térmica cualquier producto o componente más allá del funcionamiento previsto, pueden liberarse sustancias peligrosas (polvos con contenido de metales pesados como p. ej. plomo, berilio o níquel). Por eso el producto solo debe ser desmontado por personal especializado con formación adecuada. Un desmontaje inadecuado puede ocasionar daños para la salud. Se deben tener en cuenta las directivas nacionales referentes a la eliminación de residuos.
4. En caso de que durante el trato del producto se formen sustancias peligrosas o combustibles que deban tratarse como residuos especiales (p. ej. refrigerantes o aceites de motor con intervalos de cambio definidos), deben tenerse en cuenta las indicaciones de seguridad del fabricante de dichas sustancias y las normas regionales de eliminación de residuos. Tenga en cuenta también en caso necesario las indicaciones de seguridad especiales contenidas en la documentación del producto. La eliminación incorrecta de sustancias peligrosas o combustibles puede causar daños a la salud o daños al medio ambiente.

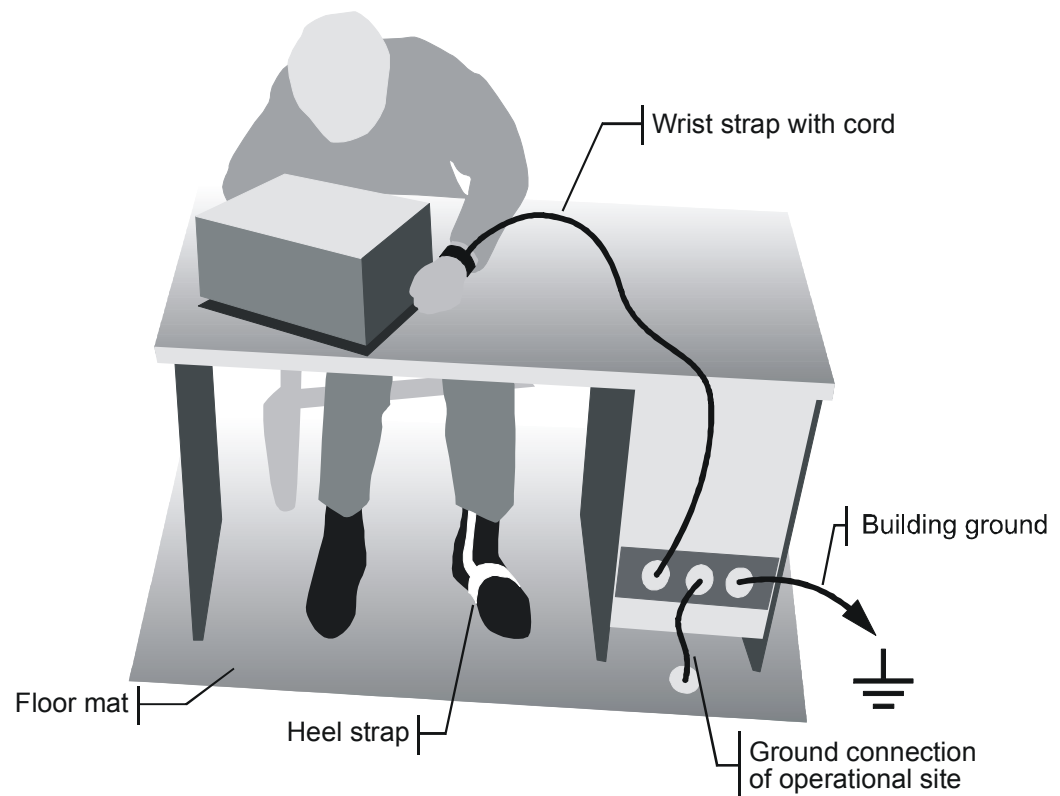
Se puede encontrar más información sobre la protección del medio ambiente en la página web de Rohde & Schwarz.

Instructions for Electrostatic Discharge Protection

NOTICE

Risk of damaging electronic components

To avoid damage of electronic components, the operational site must be protected against electrostatic discharge (ESD).



The following two methods of ESD protection may be used together or separately:

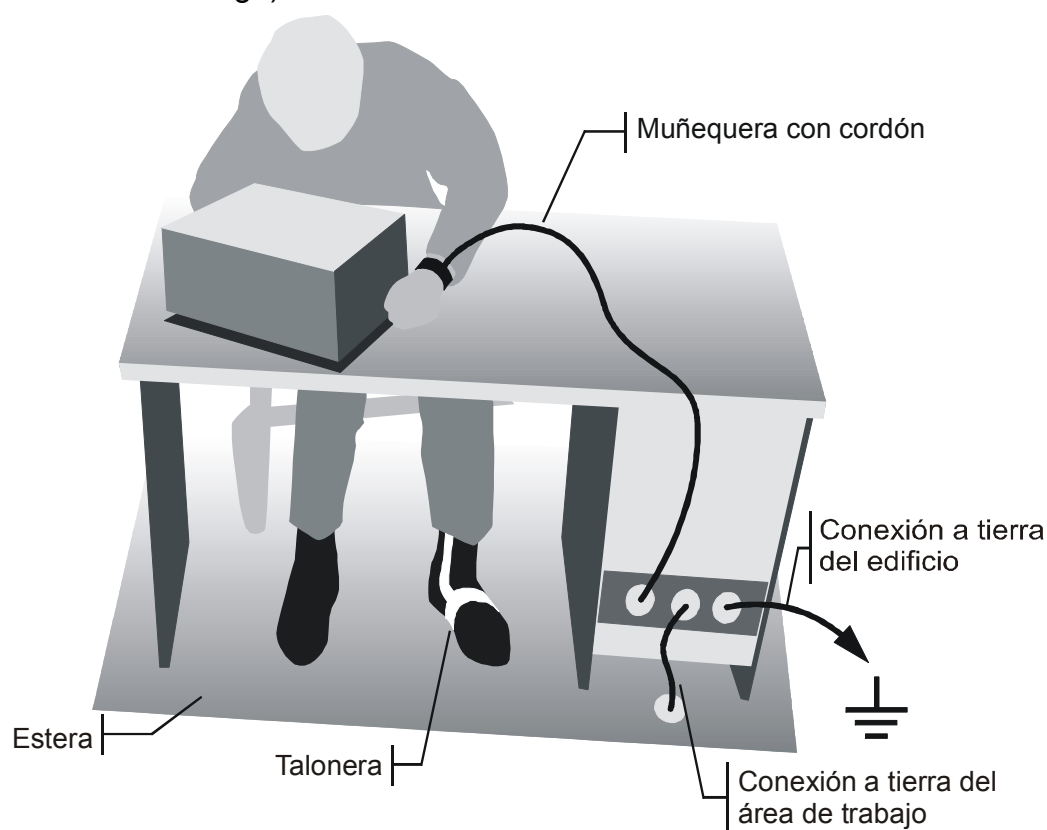
- Wrist strap with cord to ground connection
 - Conductive floor mat and heel strap combination
-

Instrucciones para la protección contra descargas electroestáticas

AVISO

Riesgo de avería de los componentes electrónicos

Para evitar averías en los componentes electrónicos, el área de trabajo tiene que estar protegido contra descargas electroestáticas ESD (electrostatic discharge).



Los siguientes dos métodos de protección ESD pueden ser usados juntos o separados:

- Muñequera con cordón para conexión a tierra
- Combinación de estera antiestática y talonera

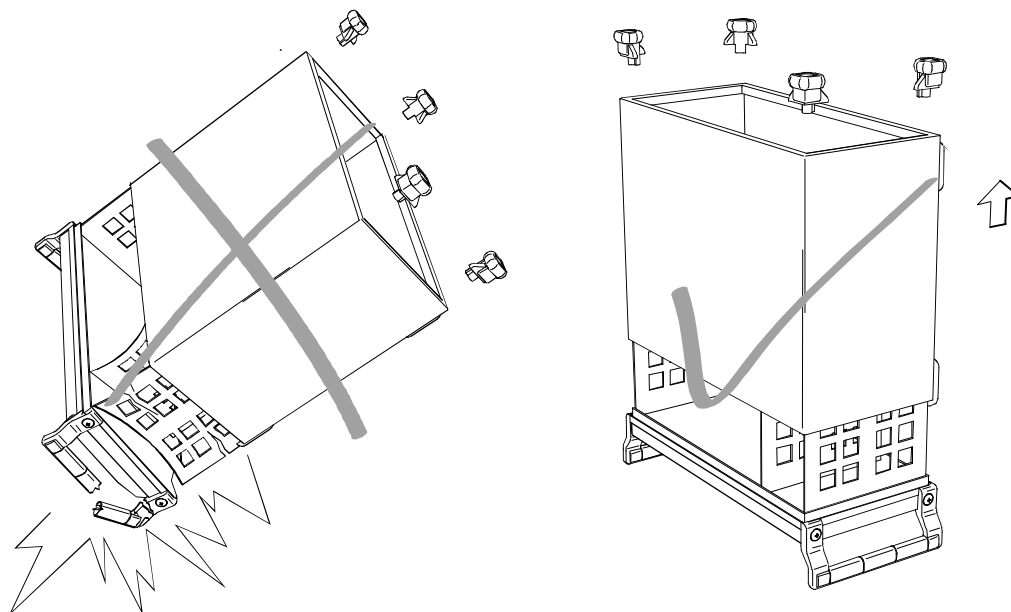
Safety Instructions for Units with Removable Cabinet

WARNING

Danger of injuries

When removing the rear feet, the unit can slip out of the cabinet.

Put the unit onto the front handles, before removing the rear feet and taking off the cabinet. Thus the risk of personal injuries and damages to the unit is avoided.



When mounting the cabinet take care not to pen in the fingers. Also pay attention not to damage or pull off cables. Screw the rear feet back on immediately after mounting the cabinet. Do not move the unit with the rear feet missing.

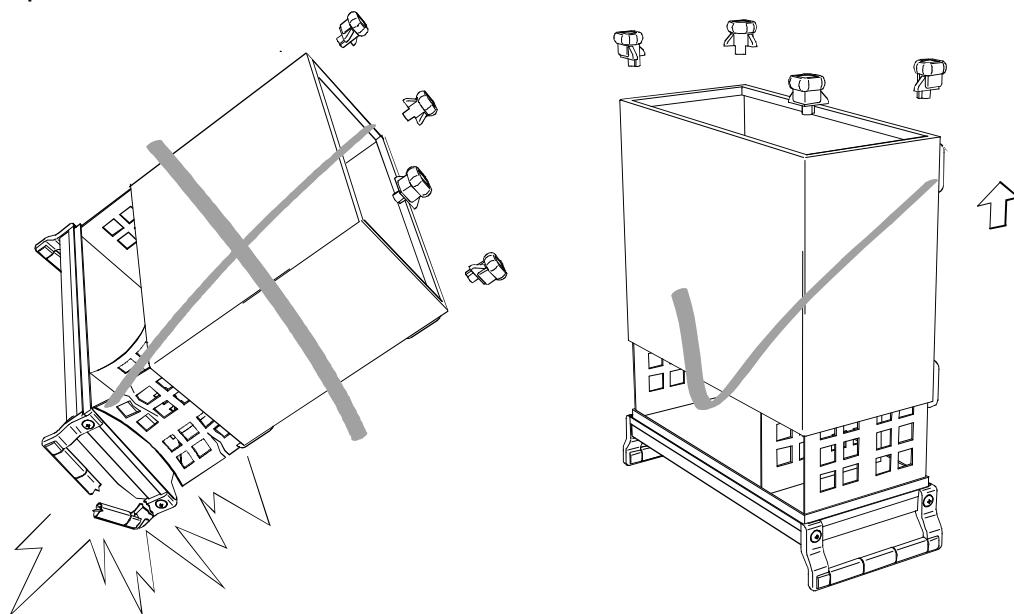
Informaciones de seguridad para aparatos con tubo de quita y pon

ADVERTENCIA

Peligro de heridas

Al sacar los pies de la pared posterior puede deslizarse el aparato fuera de la caja.

Posicionar el aparato de manera segura sobre las asas delanteras, antes de sacar los pies de la pared posterior y entonces sacar la caja. De esta manera evitarán el riesgo de daños en personas y daños en el aparato.



Existe el riesgo de heridas en el momento de poner otra vez la caja, como por ejemplo posiblemente engancharse los dedos. Por favor tengan además en cuenta de que no se enganchen o desconecten cables. Por favor atornillen los pies de la pared posterior directamente despues de poner la caja. No muevan el aparato nunca sin que los pies de la pared posterior estén atornillados.

Procedure in Case of Service and Ordering of Spare Parts

This section contains information on shipping an instrument to your service center and ordering spare parts.

Please contact your local Rohde & Schwarz service center if you need service or repair work of your equipment or to order spare parts. You can find the current address of your representative on our homepage www.rohde-schwarz.com.

Shipping the Instrument

We require the following information in order to answer your inquiry fast and correctly and to determine whether the warranty is still valid for your instrument:

- Instrument model
- Serial number
- Firmware version
- Must the instrument be returned with this firmware?
- Detailed error description in case of repair
- Indication of desired calibration
- Contact person for possible questions

In some countries, an RMA process is available for the return shipment of the instrument. For details, contact your local representative.

When shipping the instrument, be careful to provide for sufficient mechanical and antistatic protection.

- Use the original packaging for transporting or shipping the instrument. The protective caps for the front and rear prevent damage to the operating elements and the connectors.
- If you do not use the original packaging, provide for sufficient padding to prevent the instrument from slipping inside the box. Wrap antistatic packing foil around the instrument to protect it from electrostatic charging.

Rohde & Schwarz offers repair and calibrations of the test systems it produces. The calibration documentation fulfills ISO 17025 requirements.

Shipping Defective Modules

Also when shipping a module, be careful to provide for sufficient mechanical and antistatic protection.

- Ship the module in a sturdy, padded box.
- Wrap the module in antistatic foil.

If the packaging is only antistatic but not conductive, additional conductive packaging is required. The additional packaging is not required if the tightly fitting packaging is conductive.

Exception:

If the module contains a battery, the tightly fitting packaging must always consist of antistatic, non-chargeable material to protect the battery from being discharged.

Ordering Spare Parts

To deliver spare parts promptly and correctly, we need the following information:

- Stock number (see list of spare parts in chapter "Documents")
- Designation
- Component number according to list of spare parts
- Number of pieces
- Instrument type for which the spare part is needed
- Instrument stock number
- Instrument serial number
- Contact person for possible questions

Refurbished Modules

Refurbished modules are an economical alternative to original modules. Bear in mind that refurbished modules are not new, but repaired and fully tested parts. They may have traces from use, but they are electrically and mechanically equivalent to new modules.

Your Rohde & Schwarz representative will be happy to inform you about which modules are available as refurbished modules.

Taking Back Defective Replaced Modules

Defective modules of the replacement program which cannot be repaired are taken back within three months following delivery. A repurchasing value is credited.

Excluded are parts which cannot be repaired, e.g. printed boards that are burnt, broken or damaged by attempts to repair them, incomplete modules, and parts with severe mechanical damage.

Please return the defective replacement modules, together with the accompanying document for returned merchandise, which you received with the spare module. We need the following information:

- Stock number, serial number and designation of the removed part
- Detailed error description
- Stock number, serial number and type of instrument from which the module was removed
- Date of removal
- Name of the engineer/technician who replaced the module
- R&S ordering number
- Service reference number (if available)

Chapter Overview

Safety Instructions

Spare Parts Express Service
List of R&S Representatives

Contents of Manuals for Vector Network Analyzers R&S ZVB
Service and Repair

Chapter 1: Performance Test

Chapter 2: Alignment

Chapter 3: Repair

Chapter 4: Software Update / Installation of Options

Chapter 5: Documents

Index

A

Alignment	2.3
Frequency accuracy	2.6
Frequency response correction	2.7, 2.9
Level accuracy	2.9
Manual	2.4
Reference frequency	2.6
Test equipment	2.4

B

Battery	
Replacement	3.29
Block circuit	
diagram	5.3, 5.18
Block diagram	
Explanation	3.4
Board replacement	
DC/AC converter	3.32
Disk drive	3.37
Fan	3.41
Front hood	3.36
Front module processor A90	3.23
Frontend A100	3.45, 3.51
LCD	3.32
Motherboard A10	3.42
Network Controller Board A130, A140	3.54
Power supply	3.40
Power supply	3.39
Reflectometer RM8	3.45
Switching foil	3.34
Synthesizer Board	3.55
USB Board	3.38
Board Replacement	
Battery	3.29
Boards	
Overview	3.22
Boot problems	
Troubleshooting	3.64

D

Disk drive	
Replacement	3.37
Documents	5.1

F

Fan	
Replacement	3.41
Frequency accuracy	
Alignment	2.6
Check . 1.4, 1.9, 1.11, 1.12, 1.13, 1.14, 1.15, 1.16, 1.17	
Frequency Reference Board A100	
Replacement	3.57
Frequency response	
Correction	2.7, 2.9
Front hood	3.36
Front module processor	
Function	3.18
Replacement	3.23
Front unit	3.18
Frontend	
Repelcement	3.45, 3.51
Function description	3.3

H

Hard Disk	
Replacement	3.31
Hard Disk battery	
Replacement	3.31

I

Instrument construction	3.3
-------------------------------	-----

K

Keyboard	
Function	3.18
Replacement	3.34

L

LC display	3.18
LCD	
Replacement	3.32
Level accuracy	
Alignment	2.9
Lithium battery	
Replacement	3.29
LO Divider A600	
Replacement	3.56

M

Manual alignment	2.4
Mechanical Drawings	5.3
Menu, service	2.3
Motherboard	
Function	3.20
Replacement	3.42

N

Network Controller Board A130, A140	
Replacement	3.54

O

OCXO	
Function	3.14
Option B4	
Function	3.14
Installation	4.2
List	4.2

P

Password	2.3
Performance test	
Frequency accuracy	1.4, 1.9, 1.11, 1.12, 1.14, 1.15
Harmonics suppression	1.5
Level accuracy	1.6, 1.7
Level linearity	1.5, 1.8
Protocol Fehler! Textmarke nicht definiert.	1.18
Performance Test	1.1
Frequency accuracy	1.16, 1.17
Power cables	5.2
Power supply	
Function	3.19

Replacement	3.40
Replacement	3.39
Power-up problems	3.63
Precision attenuator	
Function	3.11, 3.12

R

Reflectometer RM8	
Replacement	3.45
Repairs	3.3
Replacement	
Bridge Unit	3.50
Coupler Unit	3.52
Generator and Receiver Cover	3.48
Generator Board	3.46
Inner Conductor of a Port Connector	3.49
Receiver Board	3.47
Reflectometer Fan	3.53
Reflectometer RM20	3.51

S

Software update	4.1
Spare parts	
electrical parts	5.3, 5.18

list of all parts	5.5
-------------------------	-----

T

Test equipment	
Alignment	2.4
Performance test	1.2
Test equipment	
Troubleshooting	3.62
Troubleshooting	
Power-up problems	3.63
Troubleshooting	3.62
Troubleshooting	
Boot problems	3.64
Troubleshooting	
Selftest	3.66
Troubleshooting	
Selftest	3.71
Troubleshooting	
Selftest	3.76

U

USB Board	
Board replacement	3.38

Table of Contents – Chapter 1 "Performance Test"

1 Performance Test.....	1.1
Preliminary Remarks	1.1
Test Equipment and Accessories	1.2
Performance Test	1.4
Checking the Frequency Uncertainty	1.4
Checking the Harmonics	1.5
Checking the Maximum Output Power.....	1.6
Checking the Accuracy of Output Power.....	1.7
Checking the Output Linearity	1.8
Checking the Power Measurement Uncertainty	1.9
Checking the Input Linearity.....	1.10
Checking the Input Noise Level.....	1.11
Checking the Matching (raw).....	1.12
Checking the Dynamic Range.....	1.13
Checking the Dynamic Range reduced due to Spurious	1.14
Checking the DC Measurement Inputs	1.15
Checking the optional R&S ZVB20-B80 Low Frequency Extension	1.16
000Checking the optional R&S ZVB20-B81 External Testset.....	1.17
Performance Test Report.....	1.18

1 Performance Test

Preliminary Remarks

- The required characteristics of the network analyzer are checked after a warm-up time of at least 60 minutes; this ensures that the guaranteed data is met.
- The values stated in the following sections are not guaranteed data; only the specifications in the data sheet are binding.
- The values in the data sheet are guaranteed limits. Because of the measurement errors that arise, these limits must be increased to encompass the tolerances of the measuring equipment used for the performance test.
- Entries for the measurement are represented in the following way:

[<KEY>] Press a front-panel key, e.g. [**SPAN**]

[<SOFTKEY>] Press a softkey, e.g. [MARKER → PEAK]

[<nn unit>] Enter a value + terminate the entry with a unit, e.g. [**12 kHz**]

Consecutive entries are separated with a [:], e.g. [**Meas Bandwidth** : 1 kHz]

Test Equipment and Accessories

Item	Type of equipment	Recommended characteristics or features	Recommended model	R&S Order No.	Application
1	Spectrum analyzer	a) Counter mode: Min. resolution: 100 Hz Max. rel. frequency deviation: 10^{-6} b) Linearity Max. departure from linearity (2σ): 0.06 dB c) Frequency response: 50 MHz to 4 GHz: < 1 dB 4 GHz to 8 GHz: < 1.5 dB 8 GHz to 20 GHz: < 2 dB	R&S FSU 26	1129.9003.26	Frequency uncertainty Harmonics Output linearity Input linearity
2	Power sensor	N, 50 Ω . 300 kHz to 8 GHz RSS error < 0.1 dB VSWR < 1.2	R&S NRP-Z51	1138.0005.02	Max. output power Accuracy of output power Power measurement uncertainty on R&S ZVB4/8
2	Power sensor	3.5mm, 50 Ω . 10 MHz to 20 GHz RSS error < 0.1 dB VSWR < 1.25	R&S NRP-Z55	1138.2008.02	Max. output power Accuracy of output power Power measurement uncertainty on R&S ZVB14/20
2	Power meter	300 kHz to 20 GHz	R&S NRVD + Sensor R&S ZV-Z51	0857.8008.02 0857.9004.02	Max output power Accuracy of output power Power measurement uncertainty
4	Calibration kit	N, 50 Ω . 300 kHz to 8 GHz.	R&S ZV-Z21	1085.7099.02	Input linearity Matching port 1 to port 4 Input noise level on R&S ZVB4/8
4	Calibration kit	3.5 mm, 50 Ω . 10 MHz to 20 GHz.	R&S ZV-Z32	1134.4293.02	Input linearity Matching port 1 to port 4 Input noise level on R&S ZVB14/20
5	Signal generator	300 kHz to 20 GHz, Power = -40 dBm to 10 dBm	R&S SMR27 with Option R&S SMR-B15 R&S SML01	1104.0002.27 1104.4989.02 1090.3000.11	Power measurement uncertainty
6	Power splitter	N, 50 Ohm, $\Gamma_{eq} < 0.05$ (50 MHz to 8 GHz) Output tracking < 0.15 dB	Weinschel 1870A	—	Power measurement uncertainty
6	Power splitter	3.5mm, 50 Ohm, Output tracking < 0.25 dB	Weinschel 1593	—	Power measurement uncertainty
7	Test cable	N(male) – N(male), approx. 1.5 m			Frequency uncertainty Harmonics Matching port 1 to port 4 Power measurement uncertainty Input linearity on R&S ZVB4/8

Item	Type of equipment	Recommended characteristics or features	Recommended model	R&S Order No.	Application
7	Test cable	3.5mm(male) – 3.5 mm (female), approx. 1.5 m			Frequency uncertainty Harmonics Matching port 1 to port 4 Power measurement uncertainty Input linearity on R&S ZVB14/20
8	BNC cable	Male – male, approx. 1.5 m			General: Device synchronisation
9	DC power supply	–12 V to +12 V	R&S NGSM 32/10	0192.0810.31	DC meas inputs
10	Multimeter	MU < 0.2%, DC range 1 V, 10 V	R&S URE3	0350.5315.03	DC meas inputs
11	Conn. Cables for DC inputs		R&S ZV–Z71	1164.1005.02	DC meas inputs

Performance Test

Compare with data sheet

Checking the Frequency Uncertainty

Instrument:	Spectrum analyzer (see Chapter "Test Equipment", Item1)
	Test cable (see Chapter "Test Equipment", Item7)
Test setup:	Connect the spectrum analyzer to (port 2 to port 4)
Spectrum analyzer settings:	– [PRESET] – [FREQ : 1 GHz] – [SPAN : 50 kHz] – [BW : MANUAL RES BW : 10 kHz] – [MARKER : MARKER MODE : FREQ COUNT] – [AMPT : REF LEVEL : 10 dBm]
R&S ZVB settings	– Select [System : Internal Reference] – [Preset] – [Meas :Wave Quantities: a1 Src Port 1] – [Sweep : Sweep Type : CW Mode : CW Frequency : 1 GHz; Power : 0 dBm] – [Sweep : Single : Restart]
Measurement:	Read off the frequency indicated by the marker. Frequency deviation = marker value – 1 GHz Max. frequency deviation see Performance Test Report

Checking the Harmonics

Instrument:	Spectrum analyzer (see Chapter "Test Equipment", Item1) Test cable (see Chapter "Test Equipment", Item7)
Test setup:	Connect the spectrum analyzer to port1 (port 2 to port 4)
Spectrum analyzer settings:	Note: Synchronize the reference oscillators in the spectrum analyzer and in the R&S®ZVB. – [PRESET] – [FREQ : f_{GEN}, $2 * f_{\text{GEN}}$, $3 * f_{\text{GEN}}$ *] – [SPAN : ZERO SPAN] – [BW : MANUAL RES BW : 100 Hz] – [MARKER : DETECTOR : RMS] – [AMPT : REF LEVEL : 10 dBm] * For measurement frequencies, see Performance Test Report {fGEN}.
R&S ZVB settings:	– [Preset] – [Meas : Wave Quantities: a1 Src Port 1 (a2 Src Port 2, a3 Src Port 3, a4 Src Port 4)] – [Sweep : Sweep Type : CW Mode : CW Frequency : {f_{GEN}*} ; Power : 8 dBm] – [Sweep : Single : Restart] * For measurement frequencies, see Performance Test Report {fGEN}.
Measurement:	Read off the levels $L_{n*f_{\text{gen}}}$ ($n = 1, 2, 3$) indicated by the spectrum analyzer's markers.
Calculation:	$\text{Harmonics} = L_{n*f_{\text{gen}}} - L_{f_{\text{gen}}} - \text{cable loss (in dB)}$ The cable loss corresponds to the S_{21} of the test cable used between the fundamental and the measured harmonic (S_{21} is negative).

Checking the Maximum Output Power

Instrument:	Power sensor or Power meter with power sensor (see Chapter "Test Equipment", Item2)
Test setup:	Connect power sensor to port1 (port 2 to port 4)
Power sensor settings:	For measurement frequencies, see Performance Test Report {f _{GEN} *}.
R&S ZVB settings:	– [Preset] – [Meas : Wave Quantities: a1 Src Port 1 (a2 Src Port 2 to a4 Src Port 4)] – [Sweep : Sweep Type : CW Mode : CW Frequency : {f_{GEN}*} ; Power : 16 dBm] – [Sweep : Single : Restart] * For measurement frequencies see the Performance Test Report {f_{GEN}}.
Measurement:	Read off the level indicated by the power meter. Max. power see Performance Test Report

Checking the Accuracy of Output Power

Instrument:	Power sensor or Power meter with power sensor (see Chapter "Test Equipment", Item2)
Test setup:	Connect the power sensor to port 1 (port 2 to port 4)
Power sensor settings:	For measurement frequencies, see Performance Test Report {f _{GEN} *}.
R&S ZVB settings:	– [Preset] – [Meas :Wave Quantities: a1 Src Port 1 (a2 Src Port 2, a3 Src Port 3, a4 Src Port 4)] – [Sweep : Sweep Type : CW Mode : CW Frequency : {f_{GEN}*} ; Power : –10 dBm] – [Mode : ALC : On] – [Sweep : Single : Restart] * For measurement frequencies, see Performance Test Report {f_{GEN}}.
Measurement:	Read off the levels indicated by the power sensor
	Level deviation = L _{SENSOR} – (–10 dBm)

Checking the Output Linearity

Instrument:	Spectrum analyzer (see Chapter “Test Equipment“, Item1) Test cable (see Chapter “Test Equipment“, Item7)
Test setup:	Connect the spectrum analyzer to port 1(port 2 to port 4)
Spectrum analyzer settings:	Note: Synchronize the reference oscillators in the spectrum analyzer and in the R&S®ZVB : – [PRESET] – [FREQ : f_{GEN}^*] – [SPAN : ZERO SPAN] – [BW : MANUAL RES BW : 100 Hz] – [MARKER : DETECTOR : RMS] – [AMPT : REF LEVEL : 5 dBm] – [Mode : ALC : On] * For measurement frequencies, see Performance Test Report {fGEN}.
R&S®ZVB settings:	– [Preset] – [Meas : Wave Quantities: a1 Src Port 1 (a2 Src Port 2, a3 Src Port 3, a4 Src Port 4)] – [Sweep : Sweep Type : CW Mode : CW Frequency : {f_{GEN}^*} ; Power : {I_{GEN}^*}] – [Sweep : Single : Restart] * For measurement frequencies {fGEN} and levels {I_{GEN}}, see Performance Test Report
Measurement:	Read the spectrum analyzer's marker values (level L) .
Calculation:	The measured values are referred to the level at the R&S ZVB setting of –10 dBm. Calculating the generator level linearity: Level linearity = $L - L_{@-10\text{dBm}} - \text{step width (in dB)}$ Step width = $I_{\text{gen}} - (-10 \text{ dBm})$ (reference)

Checking the Power Measurement Uncertainty

Instrument:	Power sensor or Power meter with power sensor (see Chapter "Test Equipment", Item2) Signal generator (see Chapter "Test Equipment", Item5) Power splitter (see Chapter "Test Equipment", Item6) Calibration kit (see Chapter "Test Equipment", Item4) Test cable (see Chapter "Test Equipment", Item7)
Preparation/ test setup:	Connect the signal generator to the power-splitter input using the test cable. Connect the power sensor to a power-splitter output Connect the other power-splitter output to port1 (port2 to port 4) using an adapter from the calibration kit The reference oscillators in the signal generator and in the R&S ZVB must be synchronized.
R&S® ZVB settings:	– [Preset] – [Meas : Wave Quantities: b1 Src Port 1 (b2 Src Port 2, b3 Src Port 3, b4 Src Port 4)] – [Power : RF Off] – [Meas Bandwidth : 100 Hz] – [Marker] – [Sweep : Sweep Type : CW Mode : CW Frequency : {f_{GEN}*}] – [Sweep : Single : Restart] * For the measurement frequencies, see Performance Test Report {f_{GEN}}.
Measurement:	Signal generator : CW Mode, Frequency: f_{gen} Signal-generator level: –5 dBm Adjust the signal-generator level so that the power meter reads 0 dB +/- 0.2 dB Determine the signal-generator level that gives –10 dBm at the splitter output. This level is required for the following measurement, "Checking Receiver Linearity". Read off the power meter display and the R&S ZVB marker values. Level error = L_{ZVB} – L_{PS}

Checking the Input Linearity

Instrument: Calibration kit (see Chapter "Test Equipment", Item4)

R&S®ZVB settings:

- [**Preset**]
- [**Meas** : Ratios: b1/a1 Src Port 1]
- [**Meas** : Ratios: b2/a2 Src Port 2]
- [**Meas** : Ratios: b3/a3 Src Port 3]
- [**Meas** : Ratios: b4/a4 Src Port 4]
- [**Meas Bandwidth** : 10 Hz]
- [**Marker**]
- [**Sweep** : Sweep Type : Power : Start –40dBm : Stop 10dBm :
CW Frequency : {f_{GEN}*}]
- [**Sweep** : Single : **Restart**]

* For measurement frequencies, see Performance Test Report {f_{GEN}}

1. Test setup: Connect a open male to port 1 (port 2 to port 4)

1. Measurement:

- [**Trace Funct**]
- [**Data → Mem**]
- [**Show Mem** : off]

2. Test setup: Connect a short male to port 1 (port 2 to port 4)

2. Measurement:

- [**Math = Data/Mem** : on]

Set **Ref Marker** to –10dBm

Select **Delta Mode**

Set **Marker1** to –40dBm up to +10dBm by 5dB steps

Read off the differences of the Marker Values displayed by the R&S ZVB

Checking the Input Noise Level

Test equipment	Calibration kit (see Chapter "Test Equipment", Item4)
Test setup:	Connect the Match Male from the calibration kit to port 1 (port 2 to port 4)
R&S® ZVB settings:	– [Preset] – [Meas : Wave Quantities: b1 Src Port 1 (b2 Src Port 2, b3 Src Port 3, b4 Src Port 4)] – [Power : RF Off] – [Meas Bandwidth : 10 Hz] – [Marker] – [Sweep : Sweep Type : CW Mode : CW Frequency : {f_{GEN}*}] – Service Function 1.0.0.1.1 (see chapter 3 'Service Functions', Service Level 2) – [Measure : Wave Quantities : More Wave Quantities... : Properties : Detector : RMS: Meas. Time: 500ms] – [Sweep : Single : Restart] * For measurement frequencies, see Performance Test Report {f_{GEN}}.
Measurement:	Read off the noise level indicated by the markers on the DUT.

Checking the Matching (raw)

Instrument:	Calibration kit (see Chapter "Test Equipment", Item4)
	Test cable (see Chapter "Test Equipment", Item7)
1. Preparation/ test setup:	Connect the test cable to port 1 on the R&S®ZVB and perform a 1–port calibration at the end of the cable. Connect the end of the test cable to port 2 (port3, port 4) on the R&S®ZVB.
R&S®ZVB settings:	– [Meas : S11] – [Marker] – [Add Channnel + Trace] – [Meas : S22 (S33, S44)] – [Power : –40 dBm] – [Trace Funct] – [Show Data : off] – [Trace Select : Trc 1]
1. Measurement	Read off the network analyzer's marker values (for marker frequencies see Performance Test Report)
R&S®ZVB settings:	– [Power : –40 dBm] – [Trace Funct] – [Show Data : off] – [Trace Select : Trc 2] – [Trace Funct] – [Show Data : on] – [Meas : S22] – [Marker]
2. Preparation/ test setup:	Set port 2 power to –10 dBm Connect the test cable to port 2 on the R&S®ZVB and perform a 1–port calibration at the end of the cable. Connect the end of the test cable to port 1 on the R&S®ZVB.
2. Measurement	Read off the network analyzer's marker values (for marker frequencies see Performance Test Report)

Checking the Dynamic Range

Test equipment:	Calibration kit N (see Chapter "Test Equipment", Item 4)
Test setup:	Connect Short Male to port1 and port 2 (port 3 and port 4) (use Short Female with Through Male as a second Short Male)
R&S® ZVB settings:	– [Preset] – [Meas : Ratios : b1/a2 Drive Port 2] [Meas : Ratios: b2/a1 Drive Port 1] [Meas : Ratios: b3/a4 Drive Port 4] [Meas : Ratios: b4/a3 Drive Port 3] – [Power : Max. spec. Power] – [Meas Bandwidth : 10 Hz] – [Marker] – [Sweep : Sweep Type : CW Mode : CW Frequency : {f_{GEN}*}] – Service Function 1.0.0.1.1 (see chapter 3 "Service Functions", Service Level 2) – [Measure : Wave Quantities : More Wave Quantities... : Properties : Detector : RMS: Meas. Time: 500ms] – [Sweep : Single : Restart] * For measurement frequencies, see Performance Test Report {f_{GEN}}.
Measurement:	Read off marker value
Calculation:	Nominal dynamic range: see Performance Test Report

Checking the Dynamic Range reduced due to Spurious

Only with Instruments fitted with Synthesizers 1145.xxxx

Test equipment:	Calibration kit N (see Chapter "Test Equipment", Item4)
Test setup:	Connect Short Male to port1 and port 2 (port 3 and port 4) (use Short Female with Through Male as a second Short Male)
R&S®ZVB settings:	– [Preset] – [Meas : Ratios : b1/a2 Drive Port 2] [Meas : Ratios: b2/a1 Drive Port 1] [Meas : Ratios: b3/a4 Drive Port 4] [Meas : Ratios: b4/a3 Drive Port 3] – [Start : 16 MHz] – [Number of Points : 500] – [Power : 16 dBm] – [Meas Bandwidth : 1000 Hz] – [Marker] – [Sweep : Sweep Type : CW Mode : CW Frequency : {f_{GEN}*}] – Service Function 1.0.0.1.1 (see chapter 3 'Service Functions', Service Level 2) – [Measure : Wave Quantities : More Wave Quantities... : Properties : Detector : RMS: Meas. Time: 500ms] – [Sweep : Single : Restart] * For measurement frequencies, see Performance Test Report {f_{GEN}}.
Measurement:	Read off marker value
Calculation:	Nominal dynamic range: see Performance Test Report

Checking the DC Measurement Inputs

Test equipment:	DC Power Supply NGSM 32/10 (see Chapter "Test Equipment", Item9) Multimeter R&S URE3 (see Chapter "Test Equipment", Item10) DC cable (see Chapter "Test Equipment", Item11)
Test setup:	Connect the Power Supply to the Input DC MEAS 1V (DC MEAS 10V) of the R&S ZVB using the DC cable.
R&S® ZVB settings:	– [Preset] For DC Meas 1 V: – [Meas : More : DC Inputs : DC Meas ± 1 V] – [Format : Real] – [Scale : Scale/Div : .25 x1] – [Marker] For DC Meas 10 V: – [Meas : More : DC Inputs : DC Meas ± 10 V] – [Format : Real] – [Scale : Scale/Div : 2.5 x1] – [Marker]
Measurement:	Set Power Supply to DC values U_{DC} using Multimeter R&S URE (DC values see Performance Test Report) and connect it to pos. and neg. input. Read off the DC level $U_{DC\ ZVB}$ indicated by the marker.
Calculation:	Deviation = $U_{DC} - U_{DC\ ZVB}$

Checking the optional R&S ZVB20-B80 Low Frequency Extension

Test equipment:	Test port cable
Test Setup:	Connect test port cable between: a) Test Port 1 and REF IN 1 b) Test Port 1 and MEAS IN 1 c) Test Port 2 and REF IN 2 d) Test Port 2 and MEAS IN 2
R&S® ZVAB settings:	- [PRESET] - [START FREQUENCY : 2 MHz] - [STOP FREQUENCY : 100 MHz] - [MEAS BANDWIDTH : 1 kHz] - [SWEEP : SWEEP TYPE : LOG FREQUENCY] - [MARKER : MARKER 1: 2 MHz] - [MARKER : MARKER 2: 10 MHz] a) - [MEAS : WAVE QUANTITIES : a1 SRC PORT 1] b) - [MEAS : WAVE QUANTITIES : b1 SRC PORT 1] c) - [MEAS : WAVE QUANTITIES : a2 SRC PORT 2] d) - [MEAS : WAVE QUANTITIES : b2 SRC PORT 2]
Measurement:	Read out the indicated magnitude value of the two markers for each of the four cases a) to d). The difference may not exceed 25 dB.

Checking the optional R&S ZVB20-B81 External Testset

Test equipment:	R&S ZVA24 with option R&S ZVA24-B16 and test port cable, two Short standards, and a Match standard.																
Test Setup:	Connect R&S ZVB20-B81 with R&S ZVA24 and a) connect Shorts at PORT 1 and PORT 2 of R&S ZVB20-B81 b) connect Match at PORT 1 or PORT 2 respectively of R&S ZVB20-B81 c) connect test port cable between PORT 1 and PORT 2 of R&S ZVB20-B81 d) connect Shorts at PORT 1 and PORT 2 of R&S ZVB20-B81																
R&S® ZVAB settings:	- [PRESET] - [STOP FREQUENCY : 9 GHz] - [MEAS BANDWIDTH : 1 kHz] a) - [MEAS : RATIO : b1/a1 SRC PORT 1] and [b2/a2 SRC PORT 2] - [TRACE FUNCTION : DATA→ MEM: MATH=DATA/MEM] b) read out the indicated directivity and check values c) - [POWER : +20 dBm] - [MEAS : RATIO : b2/a1 SRC PORT 1] and [b1/a2 SRC PORT 2] - [TRACE FUNCTION : DATA→ MEM: MATH=DATA/MEM] d) - [MEAS BANDWIDTH : 10 Hz] - [MEAS : Detector: RMS, Meas Time: 1 s] - read out the indicated dynamic and check values																
Specifications:	Directivity: <table> <tr> <td>10 MHz to 4 GHz</td><td>>20 dB</td></tr> <tr> <td>4 GHz to 6 GHz</td><td>>8 dB</td></tr> <tr> <td>6 GHz to 8 GHz</td><td>>6 dB</td></tr> <tr> <td>8 GHz to 9 GHz</td><td>>4 dB</td></tr> </table> Dynamic range: <table> <tr> <td>10 MHz to 100 MHz</td><td>>60 dB</td></tr> <tr> <td>100 MHz to 700 MHz</td><td>>80 dB</td></tr> <tr> <td>700 MHz to 6 GHz</td><td>>100 dB</td></tr> <tr> <td>6 GHz to 9 GHz</td><td>>80 dB</td></tr> </table>	10 MHz to 4 GHz	>20 dB	4 GHz to 6 GHz	>8 dB	6 GHz to 8 GHz	>6 dB	8 GHz to 9 GHz	>4 dB	10 MHz to 100 MHz	>60 dB	100 MHz to 700 MHz	>80 dB	700 MHz to 6 GHz	>100 dB	6 GHz to 9 GHz	>80 dB
10 MHz to 4 GHz	>20 dB																
4 GHz to 6 GHz	>8 dB																
6 GHz to 8 GHz	>6 dB																
8 GHz to 9 GHz	>4 dB																
10 MHz to 100 MHz	>60 dB																
100 MHz to 700 MHz	>80 dB																
700 MHz to 6 GHz	>100 dB																
6 GHz to 9 GHz	>80 dB																

Table 1–1: Performance Test Report

ROHDE & SCHWARZ	Performance Test Report	R&S ZVB	Version
Model (R&S ZVB4 / R&S ZVB8/R&S ZVB14 / R&S ZVB20) Item number: 1045. Serial number Tested by: Date: Signature:			

General: All Tables apply to port1; values for ports 2 to 4 are identical.

Parameter	Covered on	Min. value	Actual value	Max. value	Unit	Measurement uncertainty
Frequency deviation @ 1 GHz With Option R&S ZVAB-B4	Page 1.4	– 8000 – 100	_____ _____	+ 8000 + 100	Hz	1 Hz
Port __ Harmonics ZVB4, ZVB8 Source power +8dBm Freq. Harmonics 50 MHz 100 MHz 150 MHz 100 MHz 200 MHz 300 MHz 200 MHz 400 MHz 600 MHz 500 MHz 1000 MHz 1500 MHz 750 MHz 1500 MHz 2250 MHz 1 GHz 2 GHz 3 GHz 1.5 GHz 3 GHz 4.5 GHz 2 GHz 4 GHz 6 GHz	Page 1.5		_____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____	–20 –20 –20 –20 –20 –20 –20 –20 –20 –20 –20 –20 –20 –20	dBc	0.6 dB

Parameter	Covered on	Min. value	Actual value	Max. value	Unit	Measurement uncertainty
Port ____ Harmonics ZVB4, ZVB8 Source power +8 dBm Freq. Harmonics	Page 1.5				dBc	0.9 dB
2.1 GHz 4.2 GHz			_____	-20		
6.3 GHz			_____	-20		
2.5 GHz 5.0 GHz			_____	-20		
7.5 GHz			_____	-20		
3.0 GHz 6.0 GHz			_____	-20		
9.0 GHz			_____	-20		
3.5 GHz 7 GHz			_____	-20		
10.5 GHz			_____	-20		
4.0 GHz 8.0 GHz			_____	-20		
12.0 GHz			_____	-20		
ZVB8 only:						
4.1 GHz 8.2 GHz			_____	-20		
12.3 GHz			_____	-20		
5.0 GHz 10.0 GHz			_____	-20		
15.0 GHz			_____	-20		
5.04 GHz 10.08 GHz			_____	-20		
15.12 GHz			_____	-20		
5.05 GHz 10.10 GHz			_____	-20		
15.15 GHz			_____	-20		
6.0 GHz 12.0 GHz			_____	-20		
18.0 GHz			_____	-20		
6.35 GHz 12.70 GHz			_____	-20		
19.05 GHz			_____	-20		
6.36 GHz 12.72 GHz			_____	-20		
19.08 GHz			_____	-20		
7.0 GHz 14.0 GHz			_____	-20		
21.0 GHz			_____	-20		
8.0 GHz 16.0 GHz			_____	-20		
24.0 GHz			_____	-20		

Parameter	Covered on	Min. value	Actual value	Max. value	Unit	Measurement uncertainty
Port __ Harmonics ZVB14, ZVB20 Source power +10dBm Freq. Harmonics	Page 1.5				dBc	
50 MHz 100 MHz 150 MHz			_____	-20 -20		0.6 dB 0.6 dB
100 MHz 200 MHz 300 MHz			_____	-20 -20		0.6 dB 0.6 dB
200 MHz 400 MHz 600 MHz			_____	-20 -20		0.6 dB 0.6 dB
500 MHz 1000 MHz 1500 MHz			_____	-20 -20		0.6 dB 0.6 dB
750 MHz 1500 MHz 2250 MHz			_____	-20 -20		0.6 dB 0.6 dB
1 GHz 2 GHz 3 GHz			_____	-20 -20		0.6 dB 0.6 dB
1.5 GHz 3 GHz 4.5 GHz			_____	-20 -20		0.6 dB 0.6 dB
2 GHz 4 GHz 6 GHz			_____	-20 -20		0.6 dB 0.6 dB
2.1 GHz 4.2 GHz 6.3 GHz			_____	-20 -20		0.9 dB 0.9 dB
2.5 GHz 5.0 GHz 7.5 GHz			_____	-20 -20		0.9 dB 0.9 dB
3.0 GHz 6.0 GHz 9.0 GHz			_____	-20 -20		0.9 dB 0.9 dB
3.5 GHz 7 GHz 10.5 GHz			_____	-20 -20		0.9 dB 0.9 dB
4.0 GHz 8.0 GHz 12.0 GHz			_____	-20 -20		0.9 dB 0.9 dB
4.1 GHz 8.2 GHz 12.3 GHz			_____	-20 -20		1.1 dB 1.1 dB
5.0 GHz 10.0 GHz 15.0 GHz			_____	-20 -20		1.1 dB 1.1 dB
5.04 GHz 10.08 GHz 15.12 GHz			_____	-20 -20		1.1 dB 1.1 dB
5.05 GHz 10.10 GHz 15.15 GHz			_____	-20 -20		1.1 dB 1.1 dB
6.0 GHz 12.0 GHz 18.0 GHz			_____	-20 -20		1.1 dB 1.1 dB
6.35 GHz 12.70 GHz 19.05 GHz			_____	-20 -20		1.3 dB 1.3 dB

Parameter	Covered on	Min. value	Actual value	Max. value	Unit	Measurement uncertainty
Port __ Harmonics ZVB14, ZVB20 Source power +10dBm Freq. Harmonics	Page 1.5				dBc	
6.36 GHz 12.72 GHz			_____	-20		1.3 dB
19.08 GHz			_____	-20		1.3 dB
7.0 GHz 14.0 GHz			_____	-20		1.3 dB
21.0 GHz			_____	-20		1.3 dB
8.0 GHz 16.0 GHz			_____	-20		1.3 dB
24.0 GHz			_____	-20		1.3 dB
9.0 GHz 18.0 GHz			_____	-20		1.3 dB
11.0 GHz 22.0 GHz			_____	-20		1.4 dB

Parameter	Covered on	Min. value	Actual value	Max. value	Unit	Measurement uncertainty
Port ____	Page 1.6				dBm	0.2 dB
Max. output power						
w.o. Opt. B21 /B22/						
B23						
and w. o. Opt. B16						
Test frequency						
R&S ZVB4 and ZVB8:		10	_____			
300 kHz		10	_____			
1 MHz		10	_____			
2 MHz		10	_____			
5 MHz						
ZVB4/8 (ZVB14/20):		10 (10)	_____			
10 MHz		10 (10)	_____			
20 MHz		13 (10)	_____			
50 MHz		13 (10)	_____			
100 MHz		13 (10)	_____			
200 MHz		13 (10)	_____			
500 MHz		13 (10)	_____			
750 MHz		13 (10)	_____			
1.0 GHz		13 (10)	_____			
1.5 GHz		13 (10)	_____			
2.0 GHz		13 (10)	_____			
2.1 GHz		13 (10)	_____			
2.5 GHz		13 (10)	_____			
3.0 GHz		13 (10)	_____			
3.5 GHz		13 (10)	_____			
4.0 GHz						
ZVB8, ZVB14, ZVB20:		10	_____			
4.1 GHz		10	_____			
4.5 GHz		10	_____			
5.0 GHz		10	_____			
5.05 GHz		10	_____			
5.7 GHz		10	_____			
6.0 GHz		10	_____			
6.35 GHz		10	_____			
6.36 GHz		10	_____			
7.0 GHz						
ZVB8 only:		8	_____			
7.5 GHz		8	_____			
8.0 GHz						
ZVB14, ZVB20:		10	_____			
7.5 GHz		10	_____			
8.0 GHz		10	_____			
8.1 GHz		10	_____			
10.0 GHz		10	_____			
10.1GHz		10	_____			
12.6 GHz		10	_____			
12.7 GHz						
ZVB20 only:		5	_____			
16.0 GHz		5	_____			
16.1 GHz		5	_____			
18.0 GHz		5	_____			
20.0GHz						

Parameter	Covered on	Min. value	Actual value	Max. value	Unit	Measurement uncertainty
Port ____ Max. output power w. Opt. B16 Test frequency ZVB14 and ZVB20:	Page 1.6				dBm	0.2 dB
10 MHz		9	_____			
20 MHz		9	_____			
50 MHz		9	_____			
100 MHz		9	_____			
200 MHz		9	_____			
500 MHz		9	_____			
750 MHz		9	_____			
1.0 GHz		9	_____			
1.5 GHz		9	_____			
2.0 GHz		9	_____			
2.1 GHz		9	_____			
2.5 GHz		9	_____			
3.0 GHz		9	_____			
3.5 GHz		9	_____			
4.0 GHz		9	_____			
4.1 GHz		9	_____			
4.5 GHz		9	_____			
5.0 GHz		9	_____			
5.05 GHz		9	_____			
5.7 GHz		9	_____			
6.0 GHz		9	_____			
6.35 GHz		9	_____			
6.36 GHz		9	_____			
7.0 GHz		9	_____			
7.5 GHz		9	_____			
8.0 GHz		9	_____			
7.5 GHz		9	_____			
8.0 GHz		9	_____			
8.1 GHz		9	_____			
10.0 GHz		9	_____			
10.1GHz		9	_____			
12.6 GHz		9	_____			
12.7 GHz		9	_____			
ZVB20 only:						
16.0 GHz		3	_____			
16.1 GHz		3	_____			
18.0 GHz		3	_____			
20.0GHz		3	_____			

E-5

E-5

1145.1078.82	1.27	E-5
--------------	------	-----

Parameter	Covered on	Min. value	Actual value	Max. value	Unit	Measurement uncertainty
Port __ Power linearity w. o. Opt. B21/B22/B23 Reference –10 dBm R&S ZVB8, ZVB14, ZVB20: Freq. Level 6 GHz 20 dB – 0.8 _____ 0.8 15 dB – 0.8 _____ 0.8 10 dB – 0.8 _____ 0.8 5 dB – 0.8 _____ 0.8 –5 dB – 0.8 _____ 0.8 –10 dB – 0.8 _____ 0.8 –15 dB – 0.8 _____ 0.8 –20 dB – 0.8 _____ 0.8 ZVB8 only: –25 dB – 0.8 _____ 0.8 –30 dB – 0.8 _____ 0.8 8 GHz 18 dB – 0.8 _____ 0.8 15 dB – 0.8 _____ 0.8 10 dB – 0.8 _____ 0.8 5 dB – 0.8 _____ 0.8 –5 dB – 0.8 _____ 0.8 –10 dB – 0.8 _____ 0.8 –15 dB – 0.8 _____ 0.8 –20 dB – 0.8 _____ 0.8 ZVB8 only: –25 dB – 0.8 _____ 0.8 –30 dB – 0.8 _____ 0.8 R&S ZVB14, ZVB20: 9 GHz 20 dB – 0.8 _____ 0.8 15 dB – 0.8 _____ 0.8 10 dB – 0.8 _____ 0.8 5 dB – 0.8 _____ 0.8 –5 dB – 0.8 _____ 0.8 –10 dB – 0.8 _____ 0.8 –15 dB – 0.8 _____ 0.8 –20 dB – 0.8 _____ 0.8 11 GHz 20 dB – 0.8 _____ 0.8 15 dB – 0.8 _____ 0.8 10 dB – 0.8 _____ 0.8 5 dB – 0.8 _____ 0.8 –5 dB – 0.8 _____ 0.8 –10 dB – 0.8 _____ 0.8 –15 dB – 0.8 _____ 0.8 –20 dB – 0.8 _____ 0.8	Page 1.8				dB	0.1 dB

Parameter	Covered on	Min. value	Actual value	Max. value	Unit	Measurement uncertainty
Port __ Power linearity w. o. Opt. B21/B22/B23 Reference -10 dBm	Page 1.8				dB	0.1 dB
Freq. Level						
13 GHz 20 dB		- 0.8	_____	0.8		
15 dB		- 0.8	_____	0.8		
10 dB		- 0.8	_____	0.8		
5 dB		- 0.8	_____	0.8		
-5 dB		- 0.8	_____	0.8		
-10 dB		- 0.8	_____	0.8		
-15 dB		- 0.8	_____	0.8		
-20 dB		- 0.8	_____	0.8		
R&S ZVB20 only:						
15 GHz 20 dB		- 0.8	_____	0.8		
15 dB		- 0.8	_____	0.8		
10 dB		- 0.8	_____	0.8		
5 dB		- 0.8	_____	0.8		
-5 dB		- 0.8	_____	0.8		
-10 dB		- 0.8	_____	0.8		
-15 dB		- 0.8	_____	0.8		
-20 dB		- 0.8	_____	0.8		
17 GHz 20 dB		- 0.8	_____	0.8		
15 dB		- 0.8	_____	0.8		
10 dB		- 0.8	_____	0.8		
5 dB		- 0.8	_____	0.8		
-5 dB		- 0.8	_____	0.8		
-10 dB		- 0.8	_____	0.8		
-15 dB		- 0.8	_____	0.8		
-20 dB		- 0.8	_____	0.8		
19 GHz 20 dB		- 0.8	_____	0.8		
15 dB		- 0.8	_____	0.8		
10 dB		- 0.8	_____	0.8		
5 dB		- 0.8	_____	0.8		
-5 dB		- 0.8	_____	0.8		
-10 dB		- 0.8	_____	0.8		
-15 dB		- 0.8	_____	0.8		
-20 dB		- 0.8	_____	0.8		
20 GHz 20 dB		- 0.8	_____	0.8		
15 dB		- 0.8	_____	0.8		
10 dB		- 0.8	_____	0.8		
5 dB		- 0.8	_____	0.8		
-5 dB		- 0.8	_____	0.8		
-10 dB		- 0.8	_____	0.8		
-15 dB		- 0.8	_____	0.8		
-20 dB		- 0.8	_____	0.8		

Parameter	Covered on	Min. value	Actual value	Max. value	Unit	Measurement uncertainty
Port __ Power linearity w. Opt. B21/B22/B23 R&S ZVB4 and ZVB8 only Reference –10 dBm Freq. Level 51 MHz 15 dB 10 dB 5 dB –5 dB –10 dB –15 dB –20 dB –25 dB –30 dB –35 dB –40 dB –45 dB –50 dB –55 dB –60 dB –65 dB –70 dB –75 dB –80 dB –85 dB –90 dB 501 MHz 15 dB 10 dB 5 dB –5 dB –10 dB –15 dB –20 dB –25 dB –30 dB –35 dB –40 dB –45 dB –50 dB –55 dB –60 dB –65 dB –70 dB –75 dB –80 dB –85 dB –90 dB	Page 1.8				dB	0.1 dB
		– 0.8	_____	0.8		
		– 0.8	_____	0.8		
		– 0.8	_____	0.8		
		– 0.8	_____	0.8		
		– 0.8	_____	0.8		
		– 0.8	_____	0.8		
		– 0.8	_____	0.8		
		– 2	_____	2		
		– 2	_____	2		
		– 2	_____	2		
		– 2	_____	2		
		– 2	_____	2		
		– 2	_____	2		
		– 2	_____	2		
		– 2	_____	2		
		– 2	_____	2		
		– 3	_____	3		
		– 3	_____	3		
		– 3	_____	3		
		– 3	_____	3		
		– 3	_____	3		
		– 3	_____	3		
		– 0.8	_____	0.8		
		– 0.8	_____	0.8		
		– 0.8	_____	0.8		
		– 0.8	_____	0.8		
		– 0.8	_____	0.8		
		– 0.8	_____	0.8		
		– 0.8	_____	0.8		
		– 2	_____	2		
		– 2	_____	2		
		– 2	_____	2		
		– 2	_____	2		
		– 2	_____	2		
		– 2	_____	2		
		– 2	_____	2		
		– 2	_____	2		
		– 3	_____	3		
		– 3	_____	3		
		– 3	_____	3		
		– 3	_____	3		
		– 3	_____	3		
		– 3	_____	3		
		– 3	_____	3		

Parameter	Covered on	Min. value	Actual value	Max. value	Unit	Measurement uncertainty
Port __ Power linearity w. Opt. B21/B22/B23 R&S ZVB4 and ZVB8 only Reference –10 dBm Freq. Level 1 GHz 15 dB 10 dB 5 dB –5 dB –10 dB –15 dB –20 dB –25 dB –30 dB –35 dB –40 dB –45 dB –50 dB –55 dB –60 dB –65 dB –70 dB –75 dB –80 dB –85 dB –90 dB 2 GHz 15 dB 10 dB 5 dB –5 dB –10 dB –15 dB –20 dB –25 dB –30 dB –35 dB –40 dB –45 dB –50 dB –55 dB –60 dB –65 dB –70 dB –75 dB –80 dB –85 dB –90 dB	Page 1.8				dB	0.1 dB
		– 0.8	_____	0.8		
		– 0.8	_____	0.8		
		– 0.8	_____	0.8		
		– 0.8	_____	0.8		
		– 0.8	_____	0.8		
		– 0.8	_____	0.8		
		– 0.8	_____	0.8		
		– 2	_____	2		
		– 2	_____	2		
		– 2	_____	2		
		– 2	_____	2		
		– 2	_____	2		
		– 2	_____	2		
		– 2	_____	2		
		– 2	_____	2		
		– 2	_____	2		
		– 3	_____	3		
		– 3	_____	3		
		– 3	_____	3		
		– 3	_____	3		
		– 3	_____	3		
		– 3	_____	3		
		– 3	_____	3		
		– 0.8	_____	0.8		
		– 0.8	_____	0.8		
		– 0.8	_____	0.8		
		– 0.8	_____	0.8		
		– 0.8	_____	0.8		
		– 0.8	_____	0.8		
		– 0.8	_____	0.8		
		– 2	_____	2		
		– 2	_____	2		
		– 2	_____	2		
		– 2	_____	2		
		– 2	_____	2		
		– 2	_____	2		
		– 2	_____	2		
		– 2	_____	2		
		– 2	_____	2		
		– 3	_____	3		
		– 3	_____	3		
		– 3	_____	3		
		– 3	_____	3		
		– 3	_____	3		
		– 3	_____	3		

Parameter	Covered on	Min. value	Actual value	Max. value	Unit	Measurement uncertainty
Port __	Page 1.8				dB	0.1 dB
Power linearity w. Opt. B21/B22/B23 R&S ZVB4 and R&S ZVB8 only Reference –10 dBm						
Freq. Level						
2.1 GHz 15 dB		– 0.8	_____	0.8		
10 dB		– 0.8	_____	0.8		
5 dB		– 0.8	_____	0.8		
–5 dB		– 0.8	_____	0.8		
–10 dB		– 0.8	_____	0.8		
–15 dB		– 0.8	_____	0.8		
–20 dB		– 0.8	_____	0.8		
–25 dB		– 2	_____	2		
–30 dB		– 2	_____	2		
–35 dB		– 2	_____	2		
–40 dB		– 2	_____	2		
–45 dB		– 2	_____	2		
–50 dB		– 2	_____	2		
–55 dB		– 2	_____	2		
–60 dB		– 2	_____	2		
–65 dB		– 3	_____	3		
–70 dB		– 3	_____	3		
–75 dB		– 3	_____	3		
–80 dB		– 3	_____	3		
–85 dB		– 3	_____	3		
–90 dB		– 3	_____	3		
3 GHz 15 dB		– 0.8	_____	0.8		
10 dB		– 0.8	_____	0.8		
5 dB		– 0.8	_____	0.8		
–5 dB		– 0.8	_____	0.8		
–10 dB		– 0.8	_____	0.8		
–15 dB		– 0.8	_____	0.8		
–20 dB		– 0.8	_____	0.8		
–25 dB		– 2	_____	2		
–30 dB		– 2	_____	2		
–35 dB		– 2	_____	2		
–40 dB		– 2	_____	2		
–45 dB		– 2	_____	2		
–50 dB		– 2	_____	2		
–55 dB		– 2	_____	2		
–60 dB		– 2	_____	2		
–65 dB		– 3	_____	3		
–70 dB		– 3	_____	3		
–75 dB		– 3	_____	3		
–80 dB		– 3	_____	3		
–85 dB		– 3	_____	3		
–90 dB		– 3	_____	3		

Parameter	Covered on	Min. value	Actual value	Max. value	Unit	Measurement uncertainty
Port __ Power linearity w. Opt. B21/B22/B23 R&S ZVB4 and R&S ZVB8 only Reference –10 dBm	Page 1.8				dB	0.1 dB
4 GHz 15 dB		– 0.8	_____	0.8		
10 dB		– 0.8	_____	0.8		
5 dB		– 0.8	_____	0.8		
–5 dB		– 0.8	_____	0.8		
–10 dB		– 0.8	_____	0.8		
–15 dB		– 0.8	_____	0.8		
–20 dB		– 0.8	_____	0.8		
–25 dB		– 2	_____	2		
–30 dB		– 2	_____	2		
–35 dB		– 2	_____	2		
–40 dB		– 2	_____	2		
–45 dB		– 2	_____	2		
–50 dB		– 2	_____	2		
–55 dB		– 2	_____	2		
–60 dB		– 2	_____	2		
–65 dB		– 3	_____	3		
–70 dB		– 3	_____	3		
–75 dB		– 3	_____	3		
–80 dB		– 3	_____	3		
–85 dB		– 3	_____	3		
–90 dB		– 3	_____	3		
R&S ZVB8 only:						
4.1 GHz 12 dB		– 0.8	_____	0.8		
10 dB		– 0.8	_____	0.8		
5 dB		– 0.8	_____	0.8		
–5 dB		– 0.8	_____	0.8		
–10 dB		– 0.8	_____	0.8		
–15 dB		– 0.8	_____	0.8		
–20 dB		– 0.8	_____	0.8		
–25 dB		– 2	_____	2		
–30 dB		– 2	_____	2		
–35 dB		– 2	_____	2		
–40 dB		– 2	_____	2		
–45 dB		– 2	_____	2		
–50 dB		– 2	_____	2		
–55 dB		– 2	_____	2		
–60 dB		– 2	_____	2		
–65 dB		– 3	_____	3		
–70 dB		– 3	_____	3		
–75 dB		– 3	_____	3		
–80 dB		– 3	_____	3		
–85 dB		– 3	_____	3		

Parameter	Covered on	Min. value	Actual value	Max. value	Unit	Measurement uncertainty
–90 dB		– 3	_____	3		
Port __ Power linearity w. Opt. B21/B22/B23 Reference –10 dBm ZVB8 only: Freq. Level 6 GHz 12 dB 10 dB 5 dB –5 dB –10 dB –15 dB –20 dB –25 dB –30 dB –35 dB –40 dB –45 dB –50 dB –55 dB –60 dB –65 dB –70 dB –75 dB –80 dB –85 dB –90 dB 8 GHz 10 dB 5 dB –5 dB –10 dB –15 dB –20 dB –25 dB –30 dB –35 dB –40 dB –45 dB –50 dB –55 dB –60 dB –65 dB –70 dB –75 dB –80 dB –85 dB –90 dB	Page 1.8				dB	0.1 dB
		– 0.8	_____	0.8		
		– 0.8	_____	0.8		
		– 0.8	_____	0.8		
		– 0.8	_____	0.8		
		– 0.8	_____	0.8		
		– 0.8	_____	0.8		
		– 0.8	_____	0.8		
		– 2	_____	2		
		– 2	_____	2		
		– 2	_____	2		
		– 2	_____	2		
		– 2	_____	2		
		– 2	_____	2		
		– 2	_____	2		
		– 2	_____	2		
		– 2	_____	2		
		– 3	_____	3		
		– 3	_____	3		
		– 3	_____	3		
		– 3	_____	3		
		– 3	_____	3		
		– 3	_____	3		
		– 3	_____	3		
		– 0.8	_____	0.8		
		– 0.8	_____	0.8		
		– 0.8	_____	0.8		
		– 0.8	_____	0.8		
		– 0.8	_____	0.8		
		– 0.8	_____	0.8		
		– 2	_____	2		
		– 2	_____	2		
		– 2	_____	2		
		– 2	_____	2		
		– 2	_____	2		
		– 2	_____	2		
		– 2	_____	2		
		– 2	_____	2		
		– 3	_____	3		
		– 3	_____	3		
		– 3	_____	3		
		– 3	_____	3		
		– 3	_____	3		
		– 3	_____	3		
		– 3	_____	3		

Parameter	Covered on	Min. value	Actual value	Max. value	Unit	Measurement uncertainty
Port ____ Power measurement uncertainty	Page 1.9				dB	0.2 dB
Test frequency						
R&S ZVB4 and ZVB8:						
300 kHz		- 1	_____	1		
1 MHz		- 1	_____	1		
2 MHz		- 1	_____	1		
5 MHz		- 1	_____	1		
R&S ZVB4, ZVB8, ZVB14, ZVB20:						
10 MHz		- 1	_____	1		
20 MHz		- 1	_____	1		
50 MHz		- 1	_____	1		
100 MHz		- 1	_____	1		
200 MHz		- 1	_____	1		
500 MHz		- 1	_____	1		
750 MHz		- 1	_____	1		
1 GHz		- 1	_____	1		
1.5 GHz		- 1	_____	1		
2 GHz		- 1	_____	1		
2.1 GHz		- 1	_____	1		
2.5 GHz		- 1	_____	1		
3 GHz		- 1	_____	1		
3.5 GHz		- 1	_____	1		
4 GHz		- 1	_____	1		
R&S ZVB8, R&S ZVB14, R&S ZVB20:						
4.1 GHz		- 1	_____	1		
4.5 GHz		- 1	_____	1		
5.0 GHz		- 1	_____	1		
5.05 GHz		- 1	_____	1		
5.7 GHz		- 1	_____	1		
6.0 GHz		- 1	_____	1		
6.35 GHz		- 1	_____	1		
6.36 GHz		- 1	_____	1		
7.0 GHz		- 1	_____	1		
7.5 GHz		- 1	_____	1		
8.0 GHz		- 1	_____	1		
R&S ZVB14 and R&S ZVB20:						
9.0 GHz		- 2	_____	2		0.3 dB
11.0 GHz		- 2	_____	2		↓
13.0 GHz		- 2	_____	2		
R&S ZVB20 only:						
15.0 GHz		- 2	_____	2		
17.0 GHz		- 2	_____	2		
19.0 GHz		- 2	_____	2		
20.0 GHz		- 2	_____	2		

Parameter	Covered on	Min. value	Actual value	Max. value	Unit	Measurement uncertainty
Port __	Page 1.10				dB	0.01 dB
Input linearity						
Reference –10 dBm						
50 MHz 20 dB		–0.1	_____	0.1		
15 dB		–0.1	_____	0.1		
10 dB		–0.1	_____	0.1		
5 dB		–0.1	_____	0.1		
–5 dB		–0.1	_____	0.1		
–10 dB		–0.1	_____	0.1		
–15 dB		–0.1	_____	0.1		
–20 dB		–0.1	_____	0.1		
–25 dB		–0.1	_____	0.1		
–30 dB		–0.1	_____	0.1		
R&S ZVB4, ZVB8:						
500 MHz 20 dB		–0.1	_____	0.1		
15 dB		–0.1	_____	0.1		
10 dB		–0.1	_____	0.1		
5 dB		–0.1	_____	0.1		
–5 dB		–0.1	_____	0.1		
–10 dB		–0.1	_____	0.1		
–15 dB		–0.1	_____	0.1		
–20 dB		–0.1	_____	0.1		
–25 dB		–0.1	_____	0.1		
–30 dB		–0.1	_____	0.1		
R&S ZVB14, ZVB20:						
700 MHz 20 dB		–0.1	_____	0.1		
15 dB		–0.1	_____	0.1		
10 dB		–0.1	_____	0.1		
5 dB		–0.1	_____	0.1		
–5 dB		–0.1	_____	0.1		
–10 dB		–0.1	_____	0.1		
–15 dB		–0.1	_____	0.1		
–20 dB		–0.1	_____	0.1		
–25 dB		–0.1	_____	0.1		
–30 dB		–0.1	_____	0.1		
R&S ZVB14, ZVB20:						
2 GHz 20 dB		–0.3	_____	0.3		
15 dB		–0.3	_____	0.3		
10 dB		–0.1	_____	0.1		
5 dB		–0.1	_____	0.1		
–5 dB		–0.1	_____	0.1		
–10 dB		–0.1	_____	0.1		
–15 dB		–0.1	_____	0.1		
–20 dB		–0.1	_____	0.1		
–25 dB		–0.1	_____	0.1		
–30 dB		–0.1	_____	0.1		

Parameter	Covered on	Min. value	Actual value	Max. value	Unit	Measurement uncertainty
Port __	Page 1.10				dB	0.01 dB
Input linearity						
Reference –10 dBm						
R&S ZVB4, ZVB8:						
4 GHz 20 dB		–0.1	_____	0.1		
15 dB		–0.1	_____	0.1		
10 dB		–0.1	_____	0.1		
5 dB		–0.1	_____	0.1		
–5 dB		–0.1	_____	0.1		
–10 dB		–0.1	_____	0.1		
–15 dB		–0.1	_____	0.1		
–20 dB		–0.1	_____	0.1		
–25 dB		–0.1	_____	0.1		
–30 dB		–0.1	_____	0.1		
R&S ZVB8 only:						
4.1 GHz 20 dB		–0.1	_____	0.1		
15 dB		–0.1	_____	0.1		
10 dB		–0.1	_____	0.1		
5 dB		–0.1	_____	0.1		
–5 dB		–0.1	_____	0.1		
–10 dB		–0.1	_____	0.1		
–15 dB		–0.1	_____	0.1		
–20 dB		–0.1	_____	0.1		
–25 dB		–0.1	_____	0.1		
–30 dB		–0.1	_____	0.1		
R&S ZVB8 only:						
8 GHz 20 dB		–0.2	_____	0.2		
15 dB		–0.2	_____	0.2		
10 dB		–0.2	_____	0.2		
5 dB		–0.2	_____	0.2		
–5 dB		–0.2	_____	0.2		
–10 dB		–0.2	_____	0.2		
–15 dB		–0.2	_____	0.2		
–20 dB		–0.2	_____	0.2		
–25 dB		–0.2	_____	0.2		
–30 dB		–0.2	_____	0.2		
R&S ZVB14, ZVB20:						
7.9 GHz 20 dB		–0.3	_____	0.3		
15 dB		–0.3	_____	0.3		
10 dB		–0.1	_____	0.1		
5 dB		–0.1	_____	0.1		
–5 dB		–0.1	_____	0.1		
–10 dB		–0.1	_____	0.1		
–15 dB		–0.1	_____	0.1		
–20 dB		–0.1	_____	0.1		
–25 dB		–0.1	_____	0.1		
–30 dB		–0.1	_____	0.1		

Parameter	Covered on	Min. value	Actual value	Max. value	Unit	Measurement uncertainty
Port __ Input linearity	Page 1.10				dB	0.01 dB
Reference -10 dBm						
R&S ZVB14, ZVB20:						
8.1 GHz 15 dB		-0.3	_____	0.3		
10 dB		-0.1	_____	0.1		
5 dB		-0.1	_____	0.1		
-5 dB		-0.1	_____	0.1		
-10 dB		-0.1	_____	0.1		
-15 dB		-0.1	_____	0.1		
-20 dB		-0.1	_____	0.1		
-25 dB		-0.1	_____	0.1		
-30 dB		-0.1	_____	0.1		
14 GHz 15 dB		-0.3	_____	0.3		
10 dB		-0.1	_____	0.1		
5 dB		-0.1	_____	0.1		
-5 dB		-0.1	_____	0.1		
-10 dB		-0.1	_____	0.1		
-15 dB		-0.1	_____	0.1		
-20 dB		-0.1	_____	0.1		
-25 dB		-0.1	_____	0.1		
-30 dB		-0.1	_____	0.1		
R&S ZVB20 only:						
20 GHz 15 dB		-0.3	_____	0.3		
10 dB		-0.1	_____	0.1		
5 dB		-0.1	_____	0.1		
-5 dB		-0.1	_____	0.1		
-10 dB		-0.1	_____	0.1		
-15 dB		-0.1	_____	0.1		
-20 dB		-0.1	_____	0.1		
-25 dB		-0.1	_____	0.1		
-30 dB		-0.1	_____	0.1		

Parameter	Covered on	Min. value	Actual value	Max. value	Unit	Measurement uncertainty
Port ____	Page 1.11				dBm	
Input noise level						
w. o. Opt. –B16						
Test frequency						
R&S ZVB4 and ZVB8:						
423.450 kHz			_____	–70		–
1.12345 MHz			_____	–70		–
2.12345 MHz			_____	–70		–
5.12345 MHz			_____	–70		–
10.12345 MHz			_____	–70		–
20.12345 MHz			_____	–70		–
50.12345 MHz			_____	–70		–
R&S ZVB4/8						
(ZVB14/20):						
100.12345 MHz			_____	–110 (–70)		–
200.12345 MHz			_____	–110 (–70)		–
500.12345 MHz			_____	–110 (–70)		–
750.12345 MHz			_____	–110 (–105)		–
1000.12345 MHz			_____	–110 (–105)		–
1500.12345 MHz			_____	–110 (–105)		–
2000.12345 MHz			_____	–110 (–105)		–
2100.12345 MHz			_____	–110 (–105)		–
2500.12345 MHz			_____	–110 (–105)		–
3000.12345 MHz			_____	–110 (–105)		–
3500.12345 MHz			_____	–110 (–105)		–
3999.87655 MHz			_____	–110 (–105)		–
R&S ZVB8, ZVB14,						
ZVB20:						
4100.12345 MHz			_____	–105		–
4500.12345 MHz			_____	–105		–
5000.12345 MHz			_____	–105		–
5050.12345 MHz			_____	–105		–
5700.12345 MHz			_____	–105		–
6000.12345 MHz			_____	–105		–
6350.12345 MHz			_____	–105		–
6360.12345 MHz			_____	–105		–
7000.12345 MHz			_____	–105		–
7500.12345 MHz			_____	–105		–
7999.87655 MHz			_____	–105		–
R&S ZVB14, ZVB20:						
9000.12345 MHz			_____	–100		–
11000.12345 MHz			_____	–100		–
13000.12345 MHz			_____	–100		–
R&S ZVB20 only:						
15000.12345 MHz			_____	–100		–
17000.12345 MHz			_____	–100		–
19000.12345 MHz			_____	–100		–
19999.87655 MHz			_____	–100		–

Parameter	Covered on	Min. value	Actual value	Max. value	Unit	Measurement uncertainty
Port ____	Page 1.11				dBm	
Input noise level w. Opt. ZVB14-B16 and ZVB20-B16						
Test frequency						
ZVB14 and ZVB20:						
100.12 MHz			_____	-69		-
200.12 MHz			_____	-69		-
500.12 MHz			_____	-69		-
750.12 MHz			_____	-104		-
1000.12 MHz			_____	-104		-
1500.12 MHz			_____	-104		-
2000.12 MHz			_____	-104		-
2100.12 MHz			_____	-104		-
2500.12 MHz			_____	-104		-
3000.12 MHz			_____	-104		-
3500.12 MHz			_____	-104		-
3999.12 MHz			_____	-104		-
4100.12 MHz			_____	-104		-
4500.12 MHz			_____	-104		-
5000.12 MHz			_____	-104		-
5050.12 MHz			_____	-104		-
5700.12 MHz			_____	-104		-
6000.12 MHz			_____	-104		-
6350.12 MHz			_____	-104		-
6360.12 MHz			_____	-104		-
7000.12 MHz			_____	-104		-
7500.12 MHz			_____	-104		-
7999.12 MHz			_____	-104		-
9000.12 MHz			_____	-99		-
11000.12 MHz			_____	-99		-
13000.12 MHz			_____	-98		-
ZVB20 only:						
15000.12 MHz			_____	-98		-
17000.12 MHz			_____	-98		-
19000.12 MHz			_____	-98		-
19999.12 MHz			_____	-98		-

E-5

Parameter	Covered on	Min. value	Actual value	Max. value	Unit	Measurement uncertainty
Port __ Matching (raw) w. Opt. ZVB14-B16 and ZVB20-B16 Test frequency ZVB14 and ZVB20: 10 MHz 20 MHz 50 MHz 100 MHz 200 MHz 500 MHz 750 MHz 1 GHz 1.5 GHz 2 GHz 2.5 GHz 3 GHz 3.5 GHz 4 GHz 4.5 GHz 5 GHz 5.5 GHz 6 GHz 6.5 GHz 7 GHz 7.5 GHz 8 GHz 9.0 GHz 11.0 GHz 13.0 GHz R&S ZVB20 only: 15.0 GHz 17.0 GHz 19.0 GHz 20.0 GHz	Page 1.12				dB	1 dB

Parameter	Covered on	Min. value	Actual value	Max. value	Unit	Measurement uncertainty
Port __ Dynamic range R&S ZVB4/8 2–port unit w. o. Opt. B21/22/23 Test frequency 300 kHz 1 MHz 2 MHz 5 MHz 10 MHz 20 MHz 50 MHz 100 MHz 200 MHz 500 MHz 750 MHz 1 GHz 1.5 GHz 2 GHz 2.1 GHz 2.5 GHz 3 GHz 3.5 GHz 4 GHz R&S ZVB8 only: 4.1 GHz 4.5 GHz 5 GHz 5.05 GHz 5.7 GHz 6 GHz 6.35 GHz 6.36 GHz 7 GHz 7.5 GHz 8 GHz	Page 1.13				dB	
		80	_____			—
		80	_____			—
		80	_____			—
		100	_____			—
		100	_____			—
		100	_____			—
		100	_____			—
		120	_____			—
		120	_____			—
		120	_____			—
		120	_____			—
		120	_____			—
		120	_____			—
		120	_____			—
		120	_____			—
		120	_____			—
		120	_____			—
		120	_____			—
		117	_____			—
		117	_____			—
		117	_____			—
		117	_____			—
		117	_____			—
		117	_____			—
		117	_____			—
		117	_____			—
		115	_____			—
		108	_____			—

E-5

E-5

E-5

E-5

E-5

Parameter	Covered on	Min. value	Actual value	Max. value	Unit	Measurement uncertainty
Accuracy DC meas 1 V Pos. Input –1000 m V –300 mV –10 mV 10 mV 300 mV 1000 m V Neg. Input –1000 m V –300 mV –10 mV 10 mV 300 mV 1000 m V	Page 1.15	– 27.5 – 10.0 – 2.75 – 2.75 – 10.0 – 27.5	_____ _____ _____ _____ _____ _____	+ 27.5 + 10.0 + 2.75 + 2.75 + 10.0 + 27.5	mV	1 mV
Accuracy DC meas 10 V Pos. Input –10.0 V –3.0 V –0.1 V 0.1 V 3.0 V 10.0 V Neg. Input –10.0 V –3.0 V –0.1 V 0.1 V 3.0 V 10.0 V	Page 1.15	– 0.275 – 0.10 – 0.0275 – 0.0275 – 0.10 – 0.275	_____ _____ _____ _____ _____ _____	+ 0.275 + 0.10 + 0.0275 + 0.0275 + 0.10 + 0.275	V	0.01 V

Parameter	Covered on	Min. value	Actual value	Max. value	Unit	Measurement uncertainty
Opt. R&S ZVB20-B80	Page 1.16				dB	---
a1(2 MHz) – a1(10 MHz)			_____	25		
b1(2 MHz) – b1(10 MHz)			_____	25		
a2(2 MHz) – a2(10 MHz)			_____	25		
b2(2 MHz) – b2(10 MHz)			_____	25		
Opt. R&S ZVB20-B81	Page 1.17				dB	1 dB
Port ____						
Directivity						
Test frequency						
10 MHz		20	_____			
20 MHz		20	_____			
50 MHz		20	_____			
100 MHz		20	_____			
200 MHz		20	_____			
500 MHz		20	_____			
1.0 GHz		20	_____			
2.0 GHz		20	_____			
3.0 GHz		20	_____			
4.0 GHz		20	_____			
5.0 GHz		8	_____			
6.0 GHz		8	_____			
7.0 GHz		6	_____			
8.0 GHz		6	_____			
9.0 GHz		4	_____			
Dynamic range					dB	---
Test frequency						
10 MHz		60	_____			
20 MHz		60	_____			
50 MHz		60	_____			
100 MHz		80	_____			
200 MHz		80	_____			
700 MHz		100	_____			
1.0 GHz		100	_____			
2.0 GHz		100	_____			
3.0 GHz		100	_____			
4.0 GHz		100	_____			
5.0 GHz		100	_____			
6.0 GHz		100	_____			
7.0 GHz		80	_____			
8.0 GHz		80	_____			
9.0 GHz		80	_____			

Table of Contents - Chapter 2 "Alignment"

2 Alignment..... 2.3

 Service Menu2.3

 Manual Alignment and Recording Correction Values2.4

 Test Equipment2.4

 Aligning the Frequency Accuracy2.6

 Aligning the DC Inputs.....2.7

 Correction Value Recording and Factory System Error Calibration2.9

 Installation of the Alignment Program2.9

 Checking the Gauge.....2.9

This page has been left blank intentionally.

2 Alignment

This chapter describes the alignment of the frequency reference and the recording of correction data after a board has been replaced.

The following manual alignments or corrections can be performed on the ZVB:

- Alignment of the 10-MHz reference oscillator which determines the frequency accuracy of the ZVB
- Alignment of the DC inputs
- Recording the correction values for the generators and the receivers which determine the measurement accuracy of the ZVB's absolute values.

By performing the alignment and recording the correction values, it is possible to ensure that the ZVB is meeting its specifications by correcting any deviations.

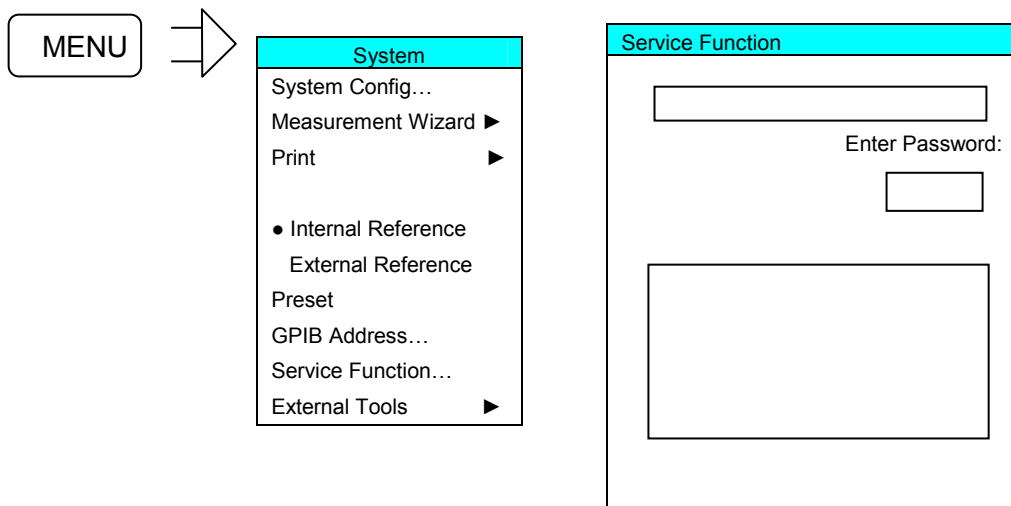
The alignments must be performed within an ambient temperature range of +22 °C to +24 °C after the appropriate warm-up time.

The ZVB meets its specs and is ready for operation when the alignment has been performed and/or correction values have been recorded and a system error calibration carried out.

Service Menu

Access to the board-alignment functions is password-protected to prevent unintentional changes to settings.

Entering the password



- Enter password 30473035.

NOTICE

The alignment shall be performed only by appropriately trained personnel because any changes made have a profound effect on the measurement accuracy of the instrument.

Manual Alignment and Recording Correction Values

In the sequel, the test equipment and the instrument preparations required to manually align the ZVB and each of the alignments are described.

Preliminary remarks

The analyzer must be allowed to warm up for at least 30 minutes before alignment. This is the only way of ensuring that the guaranteed data are met.

Test Equipment

Table 2-1 Test equipment for manually aligning the ZVB

Item	Type of equipment	Recommended specifications	Recommended model	R&S Order No.	Application
1	Spectrum analyzer	Counter mode: Min. resolution: 100 Hz Max. rel. frequency deviation: 10^{-6}	FSU 26	1166.1660.26	Frequency accuracy of the reference oscillator
2	Signal generator	300 kHz to 20 GHz	SML01 SMR20 with option SMR-B15	1090.3000.11 1104.0002.20 1104.4989.02	Recording correction values
3	Power meter	300 kHz to 20 GHz	NRVD	0857.8008.02	Recording correction values
4	Power sensor	300 kHz to 8 GHz	NRV-Z51	0857.9004.02	Recording correction values on ZVB4/8
4	Power sensor	10 MHz to 20 GHz	NRV-Z52	0857.9204.02	Recording correction values on ZVB20
5	Power splitter	N, 50 Ohm, $\Gamma_{eq} < 0.05$ (50 MHz to 8 GHz) Output tracking < 0.15 dB	Weinschel 1870A	-	Recording correction values on ZVB4/8
5	Power splitter	3.5mm, 50 Ohm, Output tracking < 0.25 dB	Weinschel 1593	-	Recording correction values on ZVB20
6	PC with GPIB-Interface	Pentium, WinXP, WinNT GR AT-GPIB IEEE4888 IF PCI National Instruments	NI-488 PCI- GPIB	1072.6101.00	Recording correction values
7	Alignment Software	ZVAB-Service		1302.4460.00	Recording correction values
8	Power supply	2x 0 to 10 V			Aligning the DC inputs
9	DC meter		URE	0350.5315.02	Aligning the DC inputs

Item	Type of equipment	Recommended specifications	Recommended model	R&S Order No.	Application
10	Calibration kit	N calibration kit	ZV-Z21	1085.7099.02	Recording correction values on ZVB4/8
10	Calibration kit	3.5mm calibration kit	ZV-Z23	1085.7099.02	Recording correction values on ZVB20
11	Test cable	Test cable N (m) to N (m).	ZV-Z11	1085.6505.03	Recording correction values on ZVB4/8
11	Test cable	Test cable 3,5mm (m) to 3,5mm (m).	ZV-Z1.	1085.6505.03	Recording correction values on ZVB20
12	Conn. Cables for DC Inputs	4-pin mini-DIN plug	ZV-Z71	1164.1005.02	Aligning the DC inputs

Aligning the Frequency Accuracy

Test equipment	Spectrum analyzer (section "Test Equipment", item 1): Error $<1 \times 10^{-9}$
Test setup:	Connect the spectrum analyzer to the 10-MHz reference output at the rear of the ZVB.
ZVB settings:	Select internal reference MENU : System: Reference Internal
Spectrum analyzer settings:	Center frequency: 10 MHz Span: 200 Hz
Note:	<i>Before the following measurement is performed, the ZVB must have been switched on for at least 30 minutes to give the reference oscillator time to warm up.</i>
Measurement:	Measure the frequency with the spectrum analyzer: Nominal frequency: Model without OCXO (Option B4) 10 MHz $\pm$ 80 Hz Model with OCXO (Option B4) 10 MHz $\pm$ 1 Hz

Alignment without Option ZVAB-B4:

- Enter Service Function 2.1.1.6.209.0x000000
- Read off the frequency-counter display, e.g. 10.000050 MHz.
- Change the **right-hand segment** (corresponding to bit 0 to bit 11) of the data word - e.g. to 000400 - instead of 000000.
- Read off the frequency counter display again, e.g. 10.000010 MHz.
- Change the left-hand segment of the data word, until the counter indicates precisely 10.000000 MHz.

Alignment with Option ZVAB-B4:

- Enter Service Function 2.1.1.6.209.0x800000.
- Read off the frequency-counter display, e.g. 10.000005 MHz.
- Change the **left-hand segment** (corresponding to bit 12 to bit 23) of the data word - e.g. to 400000 - instead of 800000.
- Read off the frequency-counter display again, e.g. 10.000001 MHz.
- Change the left-hand segment of the data word, until the counter indicates precisely 10.000000 MHz.

[illegible]

- Select Service Level 2 (see Service Functions)
- Set Service Function 3.9.0.2

At the outset, ensure that the correction parameters "Multiplier" M and "Offset" F have been preset to M=1 and F=0 for both inputs. This can be done using the Service Functions 3.1.2.5 and 3.1.2.2 which are described below under ***Service Functions***.

DC meter (URE)

DC Meas ± 10 V

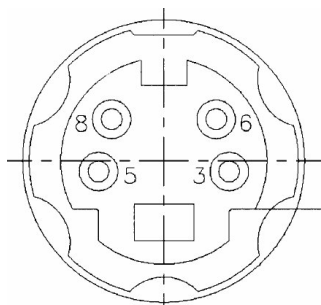
- 10 V.....pin 8, pin 5 (Gnd)

Measure : DC Inputs: DC Meas $\pm 10V$

Read off the voltages displayed by the ZVB:

V2 = negative voltage

F -> offset



Pin assignment for DC MEAS connector

The values that have been obtained in this way are now written to the hard disk using the Service Functions described below and then transferred to the EEprom of network controller1.

Example illustrating DC Meas 1 V:

When +1 V is applied, $V_1 = 1.023 \text{ V}$ is displayed by the ZVB; when -1 V is applied, $V_2 = -1.011 \text{ V}$ is displayed. The results of the calculation are $M = 1.017$ and $F = 0.0059$. The following entries are, therefore, made:

- Select Service Level 2 (see Service Functions).
- Set Service Functions (Writing to the hard disk)
 - 3.1.2.5.dc_meas_1V.DcMeasMultiplier.1.017
 - 3.1.2.5.dc_meas_1V.DcMeasOffset.0.0059
 - etc. for the second measurement input.
- Set Service Function (Writing to the EProm)
 - 3.1.2.2

When correction value programming for the two DC voltage measurement inputs has been completed, end the NWA application and restart.

Check the alignment by applying the four voltages +1 V, -1 V, +10 V and -10 V and, as a further check, 0 V.

Reading the previous DC values:

- Select **Read** in the Service Function Menu
- Set Service Functions:
 - 3.1.2.5.dc_meas_1V.DcMeasMultiplier
 - 3.1.2.5.dc_meas_1V.DcMeasOffset
 - 3.1.2.5.dc_meas_10V.DcMeasMultiplier
 - 3.1.2.5.dc_meas_10V.DcMeasOffset

Correction Value Recording and Factory System Error Calibration

Required test equipment (see Table 2-1):

- PC with IEC/IEEE bus interface
- ZVAB-Service program
- Power meter with power sensor
- Signal generator
- Calibration kit
- N-connector test cable

Installation of the Alignment Program

Install the program by double clicking on the setup.exe file.

If you install the program for the second time the install shield will only remove the old installation. You will have to start the setup.exe again to perform the installation. The tool has been tested with Windows XP and Windows NT. Connect the PC, ZVB, power meter and signal generator via the IEC/IEEE-bus interface.

For a detailed operating description e.g. dealing with

- Configuration of the Program
- Writing Synthesizer Mapping and Shift Data to the Motherboard
- Recording Correction Values
- Factory System Error Calibration

see the "Usermanual.doc" or "Usermanual.pdf" file that comes with the installation packet and is installed in the directory "C:\Program Files\Rohde&Schwarz\ZVAB-Service" on the PC.

Checking the Gauge

It is strongly recommended that every test port of the Vector Network Analyzer is gauged prior to its first use. The gauge must be recalibrated whenever the connector adapter is changed and should be checked regularly, using the gauge block, for correct zero between adapter changes.

Table Connector pin depth tolerances

Connector type	Pin depth / mm	Pos. tolerance / mm	Neg. tolerance / mm
Type N (female)	5.258	+0.000	-0.076
3.5 mm (male)	0.000	+0.076	+0.000
2.92 mm (male)	0.000	+0.076	+0.000

Procedure

1. Ensure the appropriate connector adapter is fitted to the dial gauge.
2. Attach the gauge block to the gauge interface and rotate the dial so that the indication reads zero. Lock the dial in position by tightening the screw on the side of the dial. Disconnect the gauge block.
3. Mate the connector to be measured to the gauge and note the indication.
4. The connector is "in gauge" if the indication lies between the limits set by the connector specification (see Table above). For precision type N and 3.5 mm connectors, the calibrated zero indication on the dial corresponds to one extreme, the other being $-76\text{ }\mu\text{m}$ (-0.003 in) (anti-clockwise on the dial). **CAUTION.** Damage to the connector (or the one it is to) may occur if the reading is positive.
5. After use, return the gauge set to its box.

Table of Contents - Chapter 3 "Repairs"

3 Repairs	3.3
Instrument Construction and Function Description	3.3
Block Diagrams	3.4
Description of the Block Diagrams	3.11
Board Replacement	3.21
Board Overview	3.22
Replacing Front Module Controller A90	3.23
Replacing Front Modul Controller FMR7 by FMR9	3.26
Replacing the Lithium Battery on the Front Module Controller	3.29
Replacing Hard Disk A60	3.31
Replacing LCD A70 and the DC/AC Converter	3.32
Replacing Flexible switch board (Keyboard) A16 / Key Pad A15	3.34
Replacing the Front Cover	3.36
Replacing Disk Drive A30	3.37
Replacing USB Board A40	3.38
Replacing Power Supply A20	3.39
Replacing Fuse board A21	3.40
Replacing a Fan	3.41
Replacing Motherboard A10	3.42
Replacing a Reflectometer RM8 A510 to 540	3.45
Replacing a Reflectometer RM8 A510 to 540	3.45
Replacing Generator Board (R&S ZVB4/8 only)	3.46
Replacing Receiver Board (R&S ZVB4/8 only)	3.47
Replacing Generator and Receiver Cover (R&S ZVB4/8 only)	3.48
Replacing Generator and Receiver Cover (R&S ZVB4/8 only)	3.48
Replacing the Inner Conductor of a Port Connector (R&S ZVB4/8 only)	3.49
Replacing the Bridge Unit (R&S ZVB4/8 only)	3.50
Replacing a Reflectometer RM20 A510 to 540	3.51
Replacing the Coupler Unit (R&S ZVB14/20 only)	3.52
Replacing the Coupler Unit (R&S ZVB14/20 only)	3.52
Replacing the Reflectometer Fan	3.53
Replacing Network Controller Board A130, A140	3.54
Replacing Synthesizer Board A150, A160	3.55
Replacing LO Divider A600	3.56
Replacing Frequency Reference Board A100	3.57
Replacing Frequency Reference Board A100	3.57
Assembly Instructions for R&S ZVAB-B14	3.58
Troubleshooting	3.62
Test Equipment and Accessories	3.62
Troubleshooting - Power-up Problems	3.63
Troubleshooting Boot Problems	3.64
Troubleshooting - Boot Error	3.65
Troubleshooting with the Selftest	3.66

Checking the Temperature Sensors	3.71
Service Functions	3.72
Determining which Boards are defective	3.76
Board Test	3.77
Fig. 3-1 Block diagram of the R&S ZVB4 and R&S ZVB8 2 ports	3.4
Fig. 3-2 Block diagram of the R&S ZVB4 and R&S ZVB8 4 ports (with LO-Divider)	3.5
Fig. 3-3 Block diagram of the R&S ZVB4 and R&S ZVB8 4 ports (without LO-Divider)	3.6
Fig. 3-4 Block diagram of the R&S ZVB14 and R&S ZVB20 2 ports	3.7
Fig. 3-5 Block diagram of the R&S ZVB14 and R&S ZVB20 2 ports with option B16	3.8
Fig. 3-6 Block diagram of the R&S ZVB14 and R&S ZVB20 4 ports	3.9
Fig. 3-7 Block diagram of the R&S ZVB14 and R&S ZVB20 4 ports with option B16	3.10

3 Repairs

This chapter describes the R&S ZVB's construction, simple procedures for repairs, troubleshooting and board replacement. A selftest which checks the diagnostic voltages of the board and indicates limit violations is provided for troubleshooting and diagnostics.

Chapter 4 of this service manual describes the installation of options and firmware updates.

Instrument Construction and Function Description

The R&S ZVB's construction is shown schematically by the following block diagrams and the exploded drawings (see also Chapter 5).

The block diagram will help clarify the following function description of the instrument.

Block Diagrams

See also Chapter 5, Annex and Drawings.

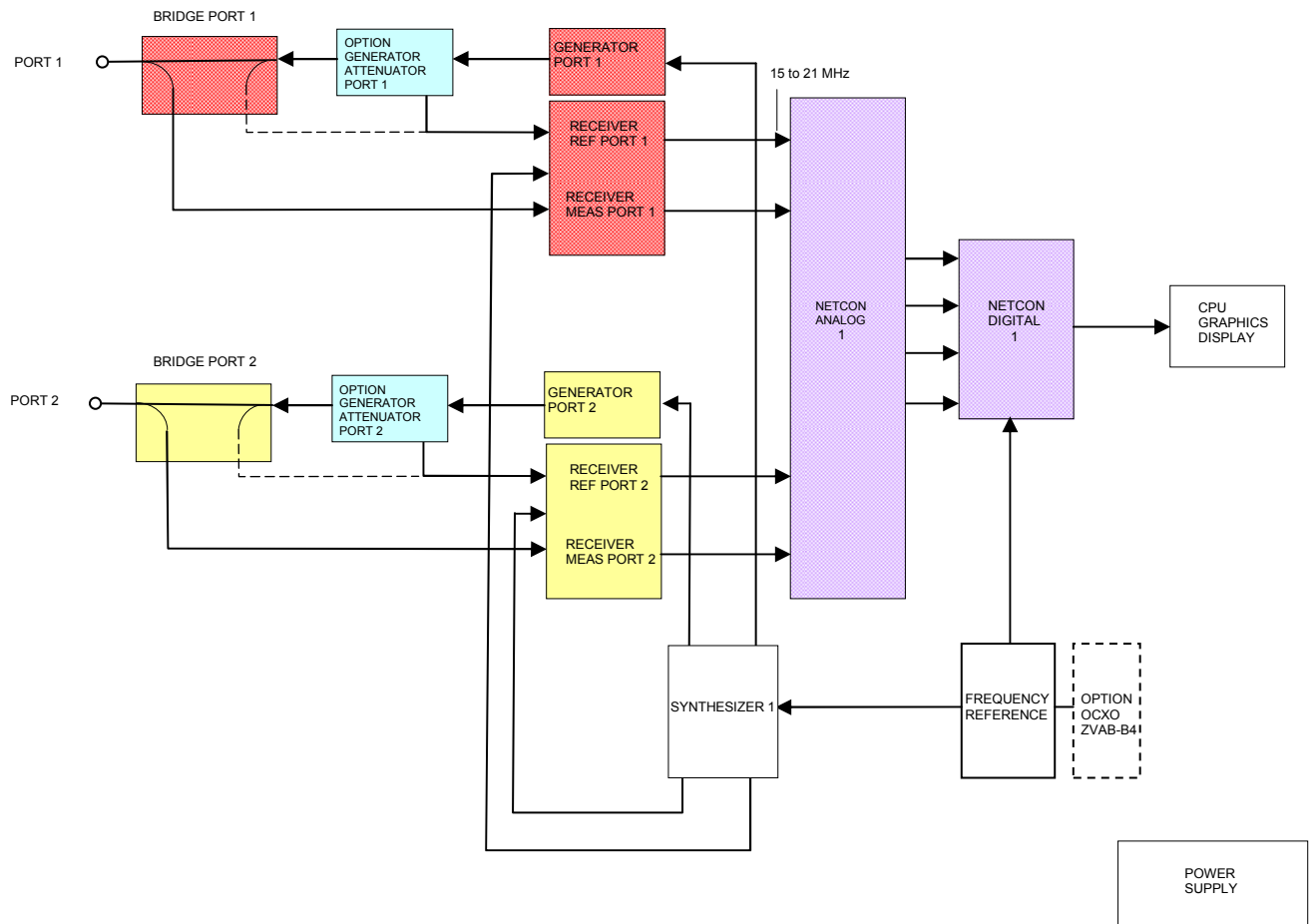
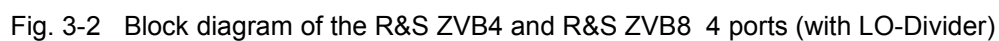


Fig. 3-1 Block diagram of the R&S ZVB4 and R&S ZVB8 2 ports



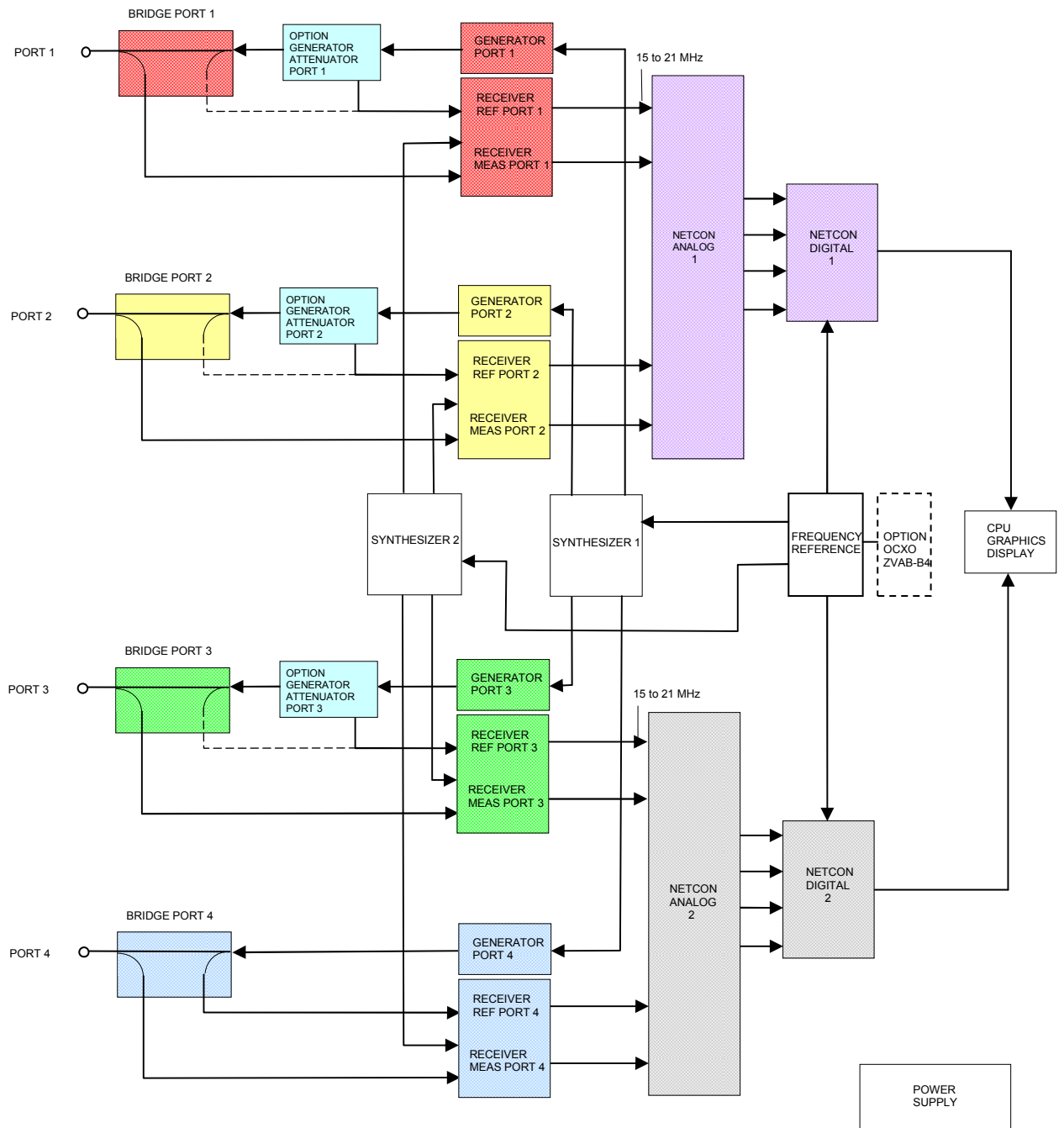


Fig. 3-3 Block diagram of the R&S ZVB4 and R&S ZVB8 4 ports (without LO-Divider)

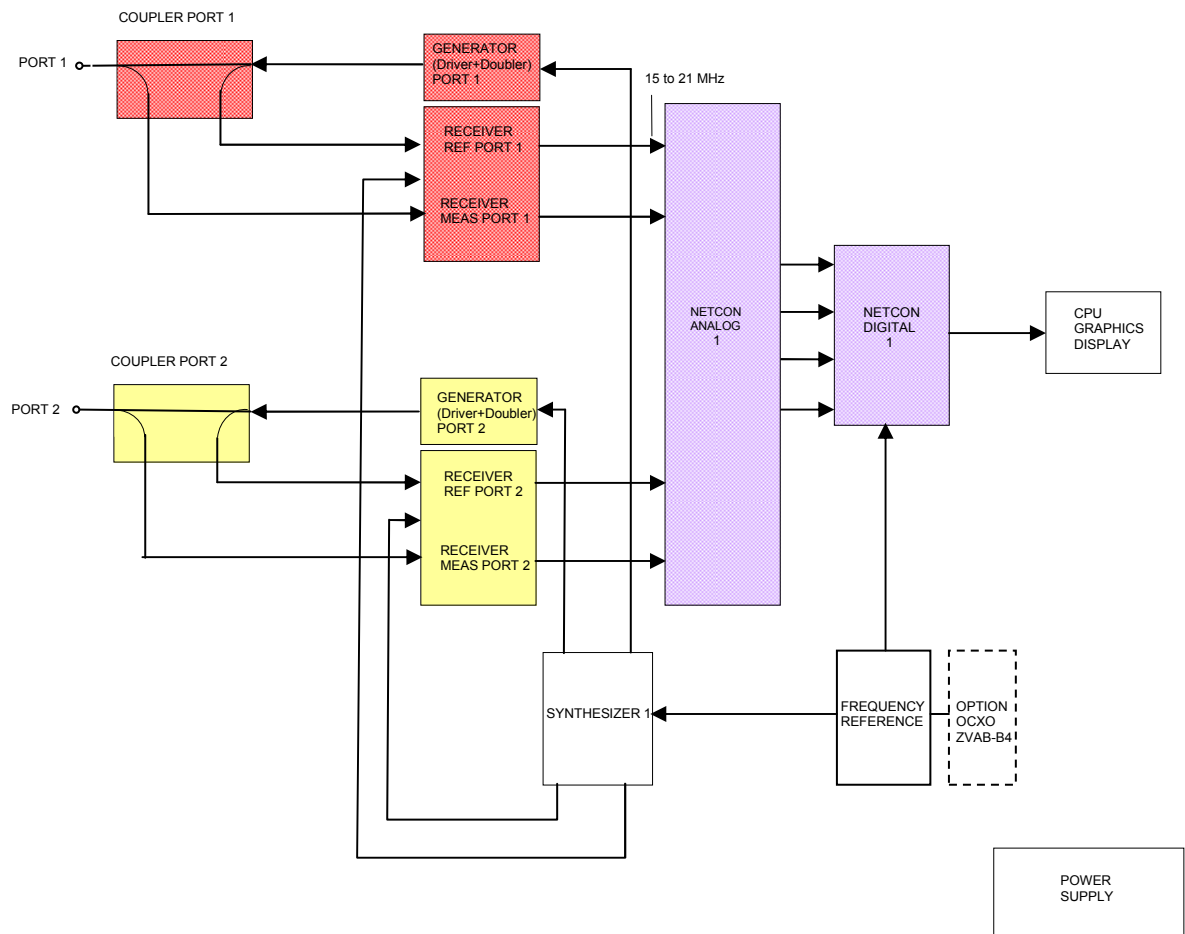


Fig. 3-4 Block diagram of the R&S ZVB14 and R&S ZVB20 2 ports

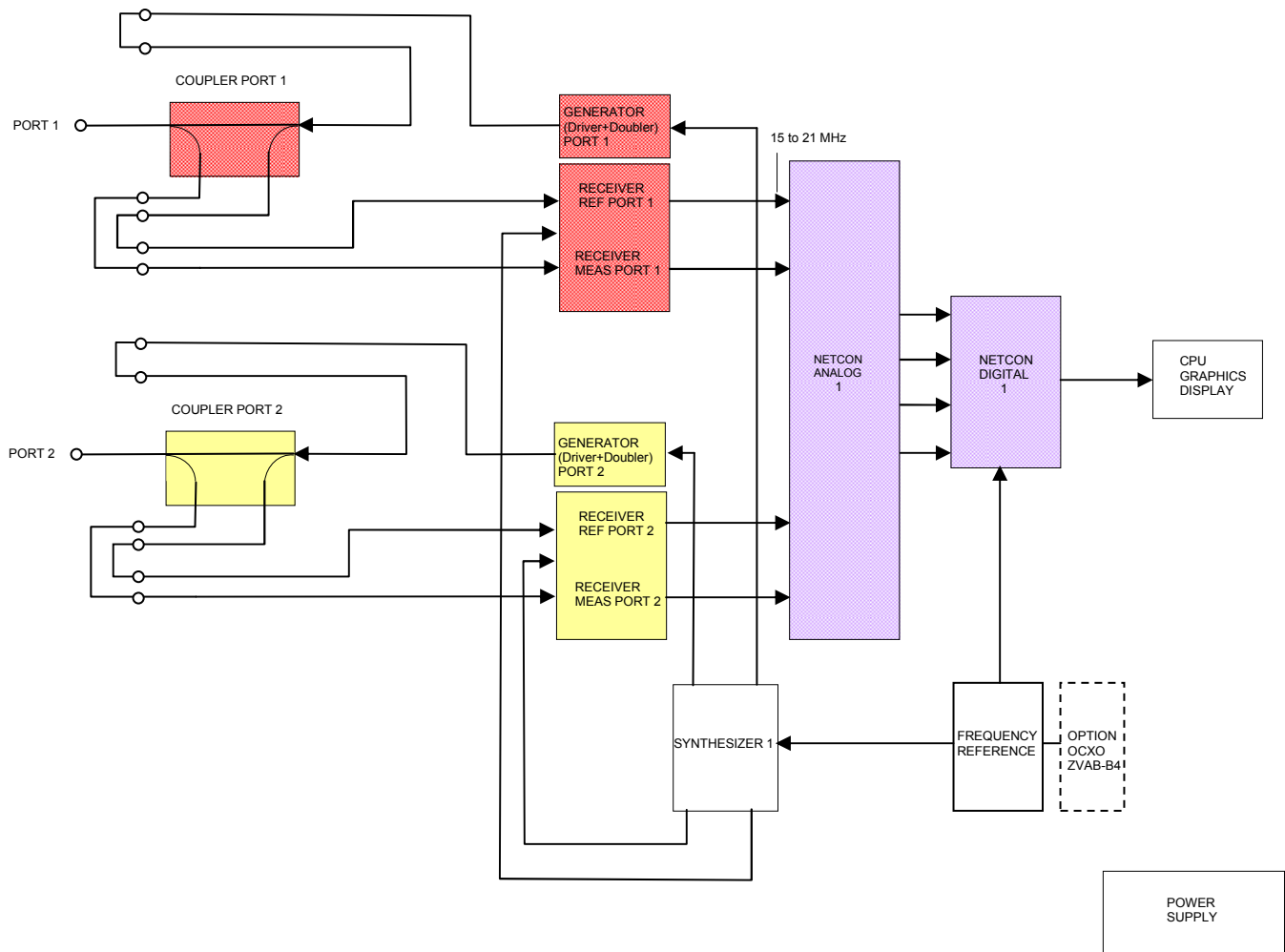


Fig. 3-5 Block diagram of the R&S ZVB14 and R&S ZVB20 2 ports with option B16

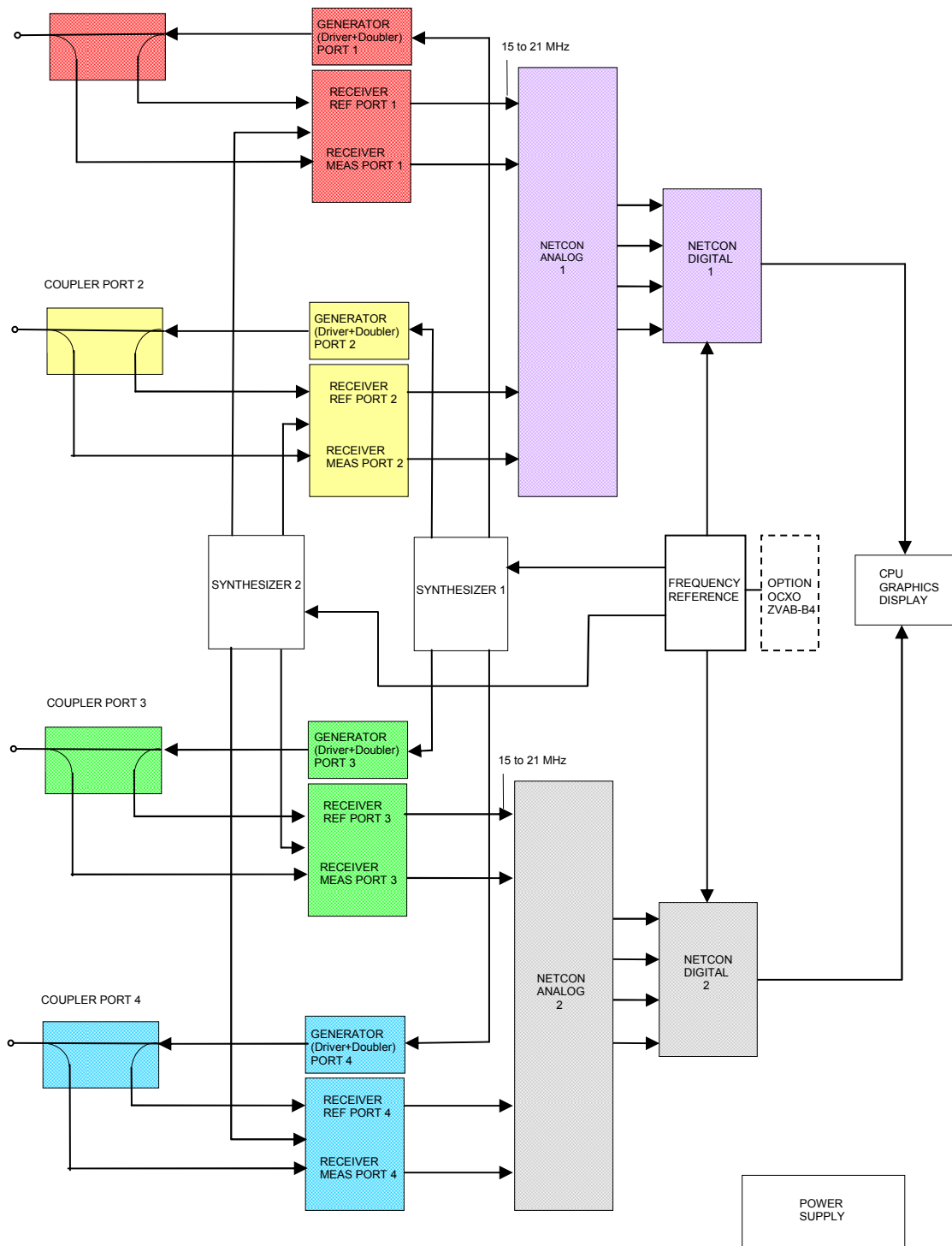


Fig. 3-6 Block diagram of the R&S ZVB14 and R&S ZVB20 4 ports

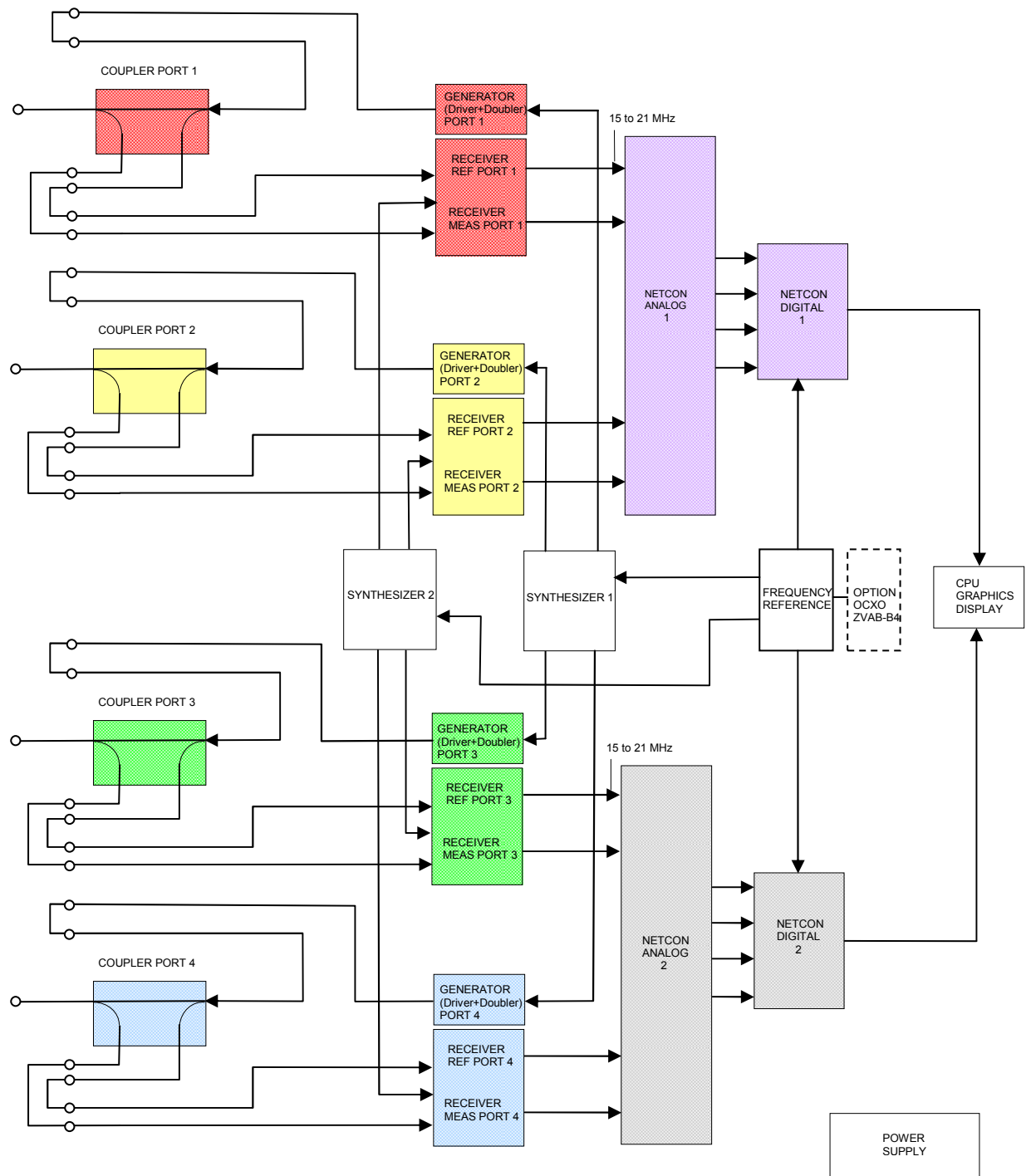


Fig. 3-7 Block diagram of the R&S ZVB14 and R&S ZVB20 4 ports with option B16

Description of the Block Diagrams

The block diagrams shown in Fig. 3-1 to Fig. 3-7 apply to the R&S ZVB4, R&S ZVB8, R&S ZVB14 and the R&S ZVB20 4 ports and 2 ports.

The R&S ZVB is a vector network analyzer covering 300 kHz to 4 GHz (R&S ZVB4), 300 kHz to 8 GHz (R&S ZVB8), 10 MHz to 14 GHz (R&S ZVB14) or 10 MHz to 20 GHz (R&S ZVB20). All models are available in a 2-port or in a 4-port version, 3-port versions are no longer available. The signals (including the LO signal for the receiver) are generated using one or two synthesizer boards, according to the number of ports. The signal processing path comprises a reflectometer board, an IF board, a network controller and a processor section, comprising a Pentium-PC, I/O interface and graphics board. The instrument can be expanded to handle future digital and analog requirements by retrofitting options.

The generator signal on R&S ZVB4/8 (300 kHz to 4 GHz or 300 kHz to 8 GHz) is generated on synthesizer board 1, amplified in the generator section of the reflectometer board and then passes via the bridge to the port (port1 to 4) and so to the DUT. The reference signal (Ref1 to 4) is split in the bridge and fed to the receiver section (Receiver Ref1 to 4) on the reflectometer board.

The generator signal on R&S ZVB14/20 (10 MHz to 14 GHz or 10 MHz to 20 GHz) is generated on synthesizer board 1, frequency multiplied, filtered and amplified in the generator section of the reflectometer board and then passes via the coupler to the port (port1 to 4) and so to the DUT. The reference signal (Ref1 to 4) is split in the coupler and fed to the receiver section (Receiver Ref1 to 4) on the reflectometer board.

The signal reflected or transmitted by the DUT (Meas1 to 4) is fed to the port, coupled out in the bridge or coupler unit and fed to the receiver section (Receiver Meas 1 to 4) on the reflectometer board.

The internal reference frequencies are generated on the frequency reference board. The 128-MHz reference frequency is generated there as an internal device reference.

The following sections describe the various boards in greater detail.

Reflectometer R&S ZVB4/8

A reflectometer board comprising a **bridge unit**, a **generator section (Generator)** and a **receiver section (Receiver)** are incorporated in every port (Port1 to 4). These three components are screwed together to form a compact unit.

Bridge unit

The bridge unit is a resistive coupler which is used to separate the signal going to the DUT from the signal coming from the DUT. The reference signal (= measure of the signal to the DUT) is also obtained from the bridge unit. The reference signal provides a reference for relative measurements.

Generator

The generator contains three broadband amplifier stages which boost the signal coming from the synthesizer to a level > 20 dBm. Limiter diodes protect the output stage from ESDs. A total of three adjustable attenuators form the setting element to keep the output level constant and to attenuate it electronically.

Receiver

The receiver section has two channels (measurement channel and reference channel) and uses single conversion. Every channel contains a buffer amplifier, two mixers for each of the frequency ranges 300 kHz to 4 GHz and 4 GHz to 8 GHz (R&S ZVB8 only) with LO amplifiers and an IF amplifier. In the mixer, the input signal is directly converted to the IF range, approx 15 to 21 MHz. The inputs are protected by limiter diodes.

Reflectometer Unit R&S ZVB14/20

A reflectometer unit comprising a **coupler unit**, a **generator section (Generator)** and a **receiver section (Receiver)** are incorporated in every port (Port1 to 4). The Generator and the Receiver are screwed together to form a compact unit.

Coupler unit

The coupler unit contains a bias-T and two directional couplers. One coupler is used to separate the signal going to the DUT from the signal coming from the DUT. The reference signal (= measure of the signal to the DUT) is obtained from the second coupler. The reference signal provides a reference for relative measurements.

Generator

The generator contains a frequency doubler for the range 8 GHz to 16 GHz, a switchable filter unit, a second frequency doubler with filter for the range 16 GHz to 20 GHz and a broadband amplifier for the frequency range 10 MHz to 20 GHz with two adjustable attenuators to keep the output level constant and to attenuate it electronically.

Range	Basic frequency range from synthesizer	Doubler 1	Frequency	Doubler 2	Output frequency
1	10 MHz to 8.0 GHz	---	10 MHz to 8.0 GHz	---	10 MHz to 8.0 GHz
2	4 GHz to 5.05 GHz	x	8.0 GHz to 10.1 GHz	---	8.0 GHz to 10.1 GHz
3	5.05 GHz to 6.35 GHz	x	10.1 GHz to 12.7 GHz	---	10.1 GHz to 12.7 GHz
4	6.35 GHz to 8.0 GHz	x	12.7 GHz to 16.0 GHz	---	12.7 GHz to 16.0 GHz
5	4.0 GHz to 5.0 GHz	x	8.0 GHz to 10.0 GHz	x	16.0 GHz to 20 GHz

Receiver

The receiver section has two channels (measurement channel and reference channel) and uses single conversion. The measurement channel contains a buffer amplifier, two mixers for each of the frequency ranges 10 MHz to 2.5 GHz and 2.5 GHz to 20 GHz, LO amplifiers and an IF amplifier. The reference channel is equal to the measurement channel without the buffer amplifier. In the mixers, the input signal is directly converted to the IF range, approx 15 to 21 MHz. The mixers are used as basic wave mixers in the range 10 MHz to 8 GHz, in the upper range harmonic mixing is used ($IF = 3LO - RF$).

Each of the reflectometers contains a voltage controlled fan to perform optimum cooling.

Network controller

The network controller comprises two boards, the **netcon analog** and the **netcon digital** which are screwed together to form a single unit. The boards are four-channel – in other words, one network controller is required for two ports (2 measurement channels + 2 reference channels). After A/D conversion, the network controller performs high-speed digital processing on the IF signals from the reflectometers.

Netcon analog

The netcon analog board is a 4-channel IF amplifier and one 14-bit A/D converter per channel. The transmission bandwidth is 13 MHz to 26 MHz. A dither generator is used to linearize the A/D-converter characteristic. The board also accommodates a temperature sensor which is only used for general temperature checks and not to correct measurement results.

Netcon digital

The netcon digital board further processes the digitized raw data from the netcon analog board. Speed considerations mean that digital signal processing is performed in an ASIC which has a clock frequency of 80 MHz.

The main functions on the board are:

- Mixing to the baseband
- Filter with bandwidths from 1 Hz to 100 kHz in 1/3/5 sequence
- Detectors, PCI interface
- Setting and routine control

The current measured value (sample), the average, the RMS and the Max can be recorded simultaneously and passed on to the main processor via the PCI-bus. The connection to the PCI-bus is made via the PCINT-FPGA. A further FPGA "FCON" contains the central section of the procedure control from measurement point to measurement point and the trigger control. This FPGA is configured by the main processor.

The A/D converters for ext. DC measurements are also accommodated on the netcon digital board.

Frequency reference

The **frequency reference** board generates the highly stable and spectrally pure clock signals, required by the R&S ZVB, which can be phase-locked to external synchronisation signals.

The various function blocks are:

The 128 MHz VCXO (voltage-controlled crystal oscillator) which generates a stable, low-noise reference frequency for the synthesisers, for the A/D converters and for digital signal processing.

The PLL for phase locking the VCXO signal to an external reference signal or to a 10 MHz OCXO (oven-controlled crystal oscillator) option.

The VCO and PLL which generate the clock for the netcon digital board (locked to the 128 MHz VCXO). The frequency can be varied from 75 MHz to 86 MHz. The VCO frequency is programmable; the nominal clock frequency is 80 MHz.

A reference frequency of 10 MHz is standard. If the OCXO is fitted, the OCXO signal is brought out at the ZVAB's rear panel (10 MHz REF) so that further instruments can be synchronised.

The free-running VCXO (no OCXO, no external reference) can be calibrated using a pre-tune voltage.

If no OCXO is fitted, a 10 MHz signal is still output at the instrument's rear panel. It is derived from the 80 MHz signal which is divided down to 10 MHz by the divider for the OCXO.

The following are also accommodated on the board:

- A control-CPLD to act as an interface between the serial bus and the board,
- Register for storing divider values,
- D/A converter for pre-tuning the VCXO and OCXO
- An on-board EEPROM for storing board-specific data
- Selftest facilities

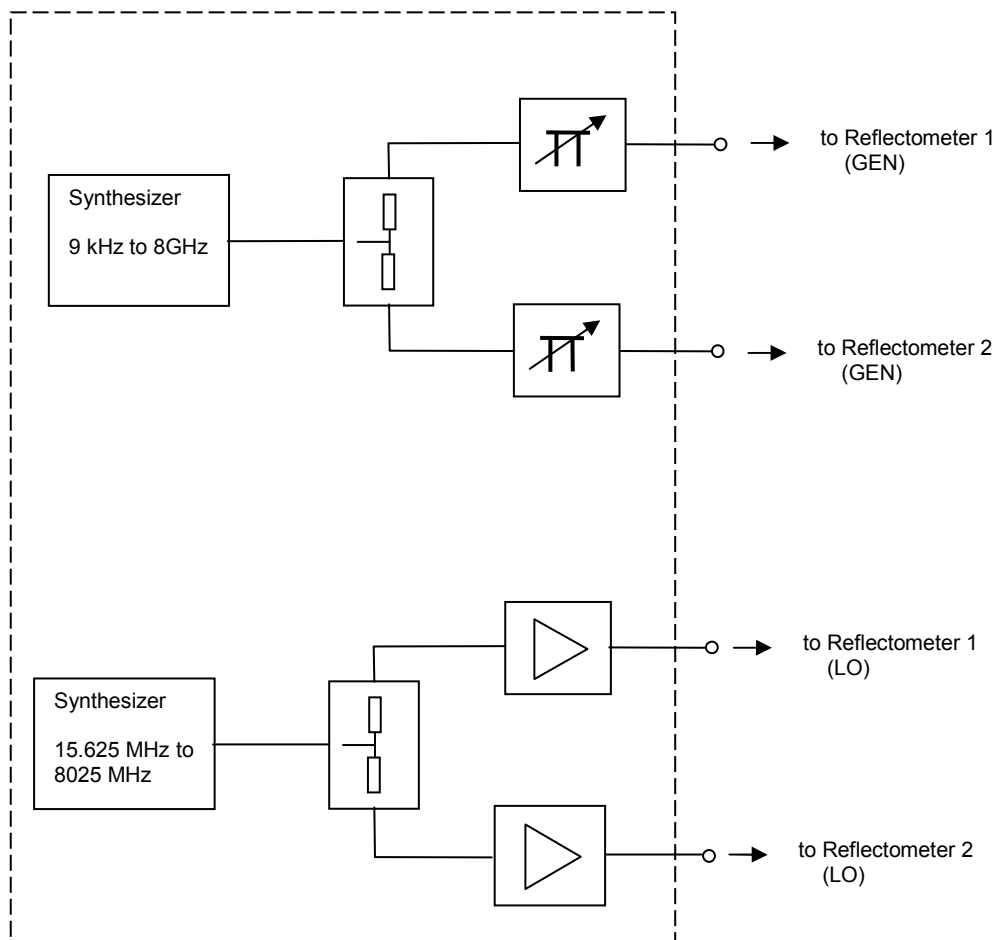
OCXO reference (option B4)

As an option, the frequency reference board can be fitted to an OCXO (oven-controlled crystal oscillator) which considerably improves the phase noise of the reference signal close to the carrier, short-term stability and long-term stability.

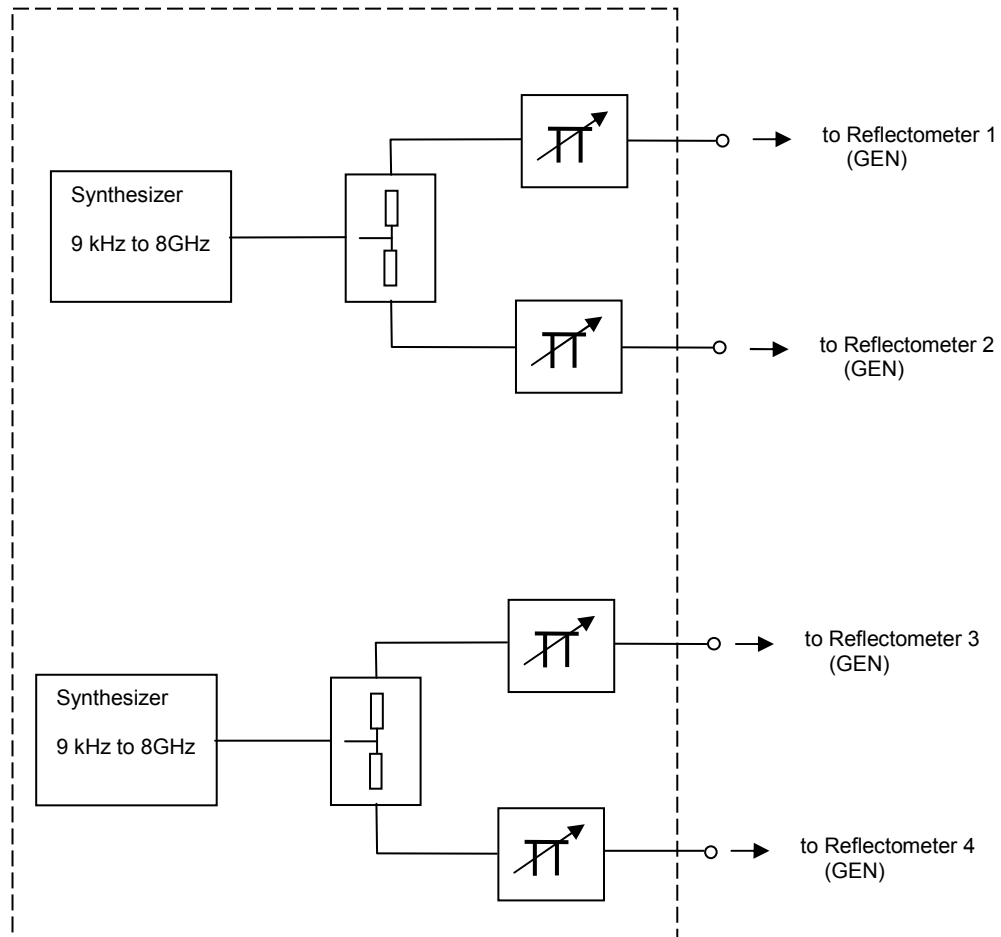
Synthesizers

The source signals for the generator signals associated with each port and the LO signal for the mixers on the receiver boards for each of the reflectometers are generated on the synthesizer board. One or two individual synthesizers are accommodated on a synthesizer board. There are three different synthesizer types used in the R&S ZVB models:

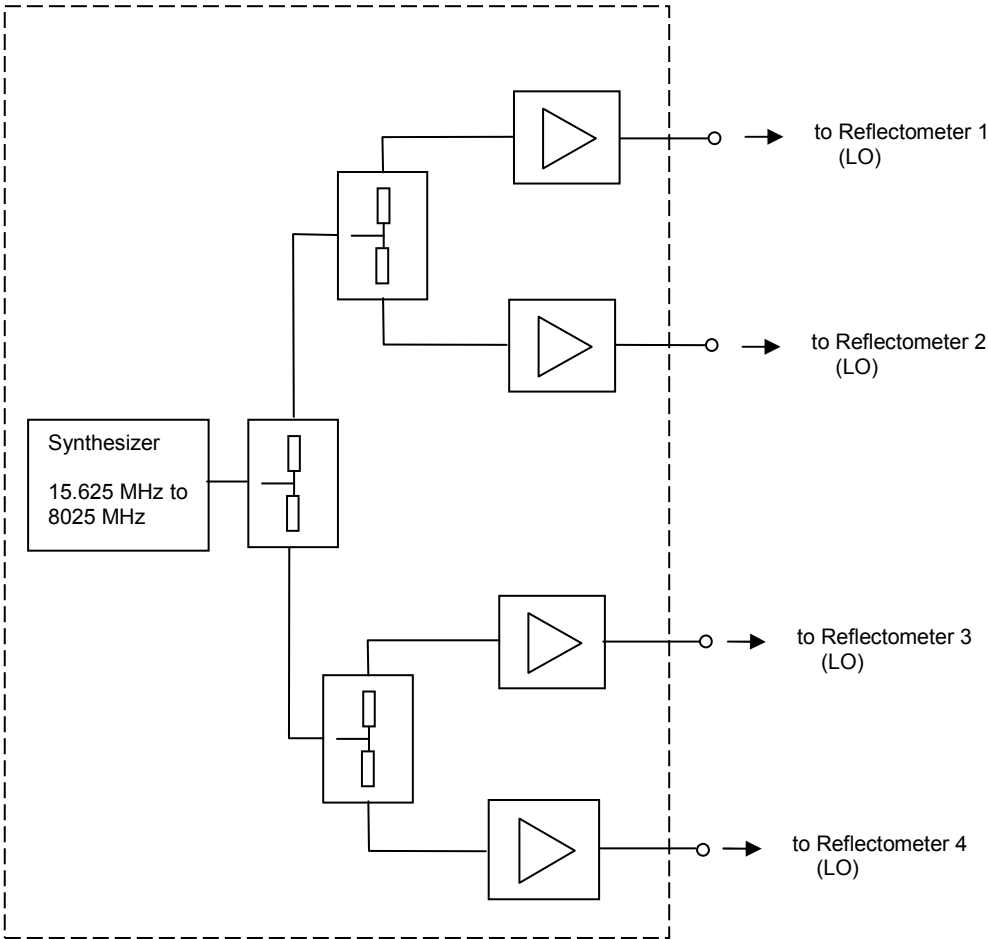
LS Synthesizer



DS Synthesizer



LO Synthesizer



The synthesizer models are incorporated as follows in the various R&S ZVB models:

	Mod	Ports	LS Synth. 1302.4025.02	LS Synth. 1302.4025.20	LO Synth. 1302.4248.02	LO Synth. 1302.4248.20	DS Synth. 1302.5180.02
R&S ZVB4	04	2	1				
R&S ZVB4	06	4			1		1
R&S ZVB8	08	2	1				
R&S ZVB8	10	4			1		1
R&S ZVB14	14	2		1			
R&S ZVB14	17	2		1			
R&S ZVB14	19	4				1	1
R&S ZVB20	20	2		1			
R&S ZVB20	23	2		1			
R&S ZVB20	25	4				1	1

LO divider

The LO signal from the synthesizer is distributed via the LO-divider board between the receiver boards associated with the reflectometers that have been installed. A maximum of four reflectometers can be supplied with the LO signal in this way. The divider comprises a resistive power divider and a buffer amplifier in each of the four output branches. The buffer amplifiers are used to compensate for the power divider loss and to provide decoupling between the reflectometers (crosstalk).

In newer instruments the LO-divider is integrated on the synthesizer board (see **Synthesizers**).

Front unit

The front unit comprises a mounting plate on which the LCD, the flexible switch board and key pad, and the tachogenerator are accommodated.

The front module controller is mounted in the controller tray in the instrument frame.

LC display

All results and setting information the user requires is displayed on the colour LCD.

The resolution of the LCD is 800 x 600 pixels (SVGA).

The display has an integral cold-cathode tube to provide illumination. The high voltage that is required is provided by a dedicated DC/AC converter. The converter is mounted on the mounting plate next to the display and connected to both the display and the controller board via a cable.

Keyboard

The keyboard comprises a flexible switch board and a key pad. They make contact whenever a rubber key is pressed. The two LEDs for the status display associated with the Standby/On key (yellow for standby/green for on) are also accommodated on the key pad.

Key detection and LED control are performed via a foil cable connection on the controller board. They are controlled by means of a matrix method implemented by a special microprocessor on the controller board; the two LEDs are controlled accordingly. When the instrument is turned off at the mains switch, the microprocessor saves the status of the Standby/On key.

Front module controller

The front module controller accommodates all the components that are required on one board - for example, the processor, memory chips (SIMMs), I/O chips, the lithium battery, IEC/IEEE bus controller, ethernet interface, HD controller, USB controller, LCD graphics controller, external monitor graphics interface (Monitor).

Only up to FMR7: Two serial interfaces (COM1/2), a parallel interface (LPT), floppy controller and a connector for an external keyboard (keyboard PS/2).

Hard disk

The hard disk is screwed to the rear of the tray for the front module controller with a holder and connected to the board with a flat cable.

Power supply

The power supply produces all the voltages required to power the R&S ZVB. It can be turned off with a switch on the instrument's rear panel.

The power supply is a primary-switched power supply with power factor correction (PFC) and standby circuit (+12 V standby).

On the secondary side, it outputs DC voltages (+3.4 V, +5.2 V, +6.5 V, +8.25 V, +12.25 V, +12 V standby, -12.25 V).

The control signal RS_PS_ON which is controlled by the front module controller (via the *STANDBY/ON* key at the front of the instrument frame), activates the power supply. In the standby mode, the power supply generates only the 12-V standby voltage to supply a crystal oven and the STANDBY status display on the front panel.

The secondary voltages are open-proof and short-proof to ground and mutually open-proof and short-proof.

A circuit that prevents overheating is also provided. Overheating is indicated to the front module controller via a status signal (*OT*).

Motherboard

The motherboard supplies power to the boards and connects them to the control and data buses. A number of RF connections are also routed via the motherboard.

As well as straight connections, a number of circuits are accommodated on the motherboard:

Motherboard controller (MBCON)

28 V supply

Preamplifier for the DC measurement inputs

Supply voltage fuses

Rear panel interfaces

Fan control

The **MBCON** unit acts as an FSU bus-slave:

- to drive the LEDs (instrument front-panel)
- to drive the fan in five stages
- for two temperature sensors on the motherboard
- for an SPI-EEPROM on the motherboard
- Furthermore, the software can detect which device (R&S ZVB4 to R&S ZVB20) is present using the MBCON.

In addition to the voltages delivered by the power supply, +28 V is produced from +12 V on the motherboard by means of a boosting switching regulator. This voltage is required to operate the OCXO on the reference board when option B4 is fitted.

Each board has its own fuses for the supply voltages. These fuses are soldered into position on the board.

All external supply voltages (USB etc.) are protected to prevent shorts.

Board Replacement

The following section is a detailed description of board replacement. Chapter 5 tells you how to order spare parts. It contains a list of mechanical parts and their order numbers as well as drawings relating to board replacement.



The numbers in brackets are the item numbers in the list of mechanical parts in Chapter 5.

In turn, these item numbers are the same as the item numbers in the drawings relating to board replacements (also in Chapter 5).

The terms “left” and “right” always mean left and right as seen looking at the front of the instrument.

Board Overview

Table 3-1 Overview: Board Replacement

Board	Actions after replacement		
	Function test	Alignment Recording of correction values System error calibration	Other
Front module controller	Check error log		BIOS update
Lithium battery	Check error log		
Hard disk	Check error log	System error calibration	FW update
LC display / DC/AC converter	Functional test		
Flexible switch board (keyboard)/ key pad	Functional test		
Front cover			
Disk drive	Check the directory structure		
USB board	Test with mouse, keyboard		
Power supply	Check error log		
Fan			
Motherboard	Check error log	Alignment DC measurement inputs	
Reflectometer	Check error log	Record correction values System error calibration	
Input connector port 1 to 4 (R&S ZVB4/8 only)	Check error log	System error calibration	
Bridge unit (R&S ZVB4/8 only)	Check error log	Record correction values System error calibration	
Coupler unit (R&S ZVB20/22 only)	Check error log	Record correction values System error calibration	
Reflectometer fan	Check error log		
Network controller	Check error log	Record correction values System error calibration Alignment DC measurement inputs	
Synthesizer	Check error log	Record correction values System error calibration	
LO divider	Check error log	Record correction values System error calibration	
Frequency reference	Check error log	Alignment Frequency accuracy	

Replacing Front Module Controller A90

(See Chapter 5, Spare Parts List, Item 580, and drawings 1145.1010, 1145.1290)

The front module controller is located behind the front unit.

Opening the instrument and removing the front unit

- Turn off the instrument and disconnect from the mains.
- Remove the 4 screws from the front handles (410), left and right, and take off the front handles.
- Remove 3.5 mm connection cables (only with option R&S ZVBx-B16)
- Remove the countersunk screw (390) next to the display and pull off the front cover (300 to 330) forwards
- Remove the 2 countersunk screws (610) in the top of the front frame and the 2 in the bottom.
- Remove the countersunk screws (176) (4), (177) (6), (178) (8)
- Pull out the front unit together with the keyboard and display (600, 601, 602, 603) forwards.

NOTICE

The cables to the front module controller are still connected.

- Disconnect the cables to the LCD, the DC/AC illumination converter, the key pad (keyboard), the tachogenerator and, if necessary, the network connection on the front module controller.

N.B.: When disconnecting cables, be especially careful with the cable to the keyboard. It is a foil cable and can only be removed when the locking device on the foil-cable connector is released.

Removing the front module controller

- Remove the 10 semi screws (590) in the front module controller and remove the front module controller in the following way (see Fig. 3-2):

Note:

The insertion force for the front module controller on the motherboard is very large.

The slot in the bottom of the controller tray is provided to facilitate pushing out the front module controller forwards.

Using a blunt, flat tool, carefully edge the board forwards.

NOTICE

Do not insert the tool too far into the slot; only apply pressure to the board.

To ease the board out, apply light pressure to each and every slot.
Do not bend the board.

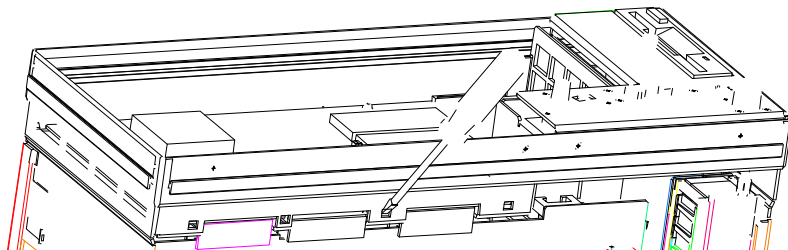


Fig. 3-2 Removing the front module controller

Installing the new front module controller and putting the instrument back together

Carefully insert the new front module controller on the motherboard and screw into place with 10 semi screws (590).

Caution: With type FMR6 1091.2520.00, there is a danger of shorting between board components, tracks and screws (590). Use suitable insulation.

Reconnect the cables to the front module controller, ensuring correct polarity.

Front Module Controller Typ FMR6

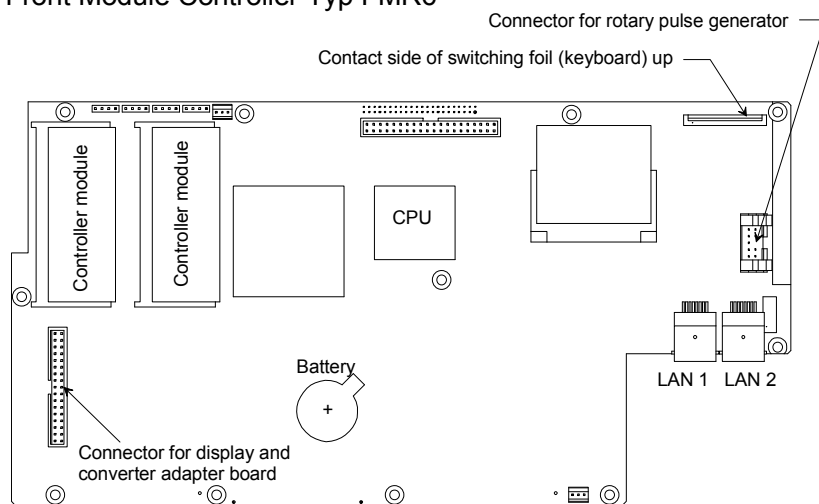


Fig. 3-3 Location of the edge connectors on the front module controller

- Re-insert the front unit into the instrument and secure to the front frame with 4 countersunk screws. (610).
- Fit the following countersunk screws (176) (4), (177) (6), (178) (8).

NOTICE

Avoid trapping cables and ensure cabling is tidy.

- Replace the front cover (300 to 330) and screw in the countersunk screw (390).
- Reconnect the 3.5mm connection cables (only with option R&S ZVBx-B16)
- Secure the 2 front handles (410) with the 4 screws.

Putting into operation

- Connect the mains cable and turn on at the power on switch. The instrument is now in standby mode.
- Insert the BIOS disk in the floppy disk drive.
- Turn on the instrument and wait for the first beep. Press the DEL key. The instrument should now display the setup menu.
 - Select Advanced BIOS Features
 - Enter
 - Select First Boot Device
 - Select Floppy using page up/down key
 - Press F10 key (save)
 - Enter
- BIOS has now been programmed.
Do not turn the instrument off when the program is running.
- Follow the instructions on the screen.
- Select Service Level 2 (see Service Functions).
- Check the protocol file for errors:
[INFO : Error Log]

Replacing Front Modul Controller FMR7 by FMR9

The swap from the Frontmodul FMR7/x to FMR9/6 may only implemented by an authorized service center.

Saving customers data

- It's recommended asking the customer to save all data from the instrument for later recovery.
- After installation of the FMR9/6 and SATA hard disk all customer – specific settings and data will be gone!

Creating a backup of instrument specific

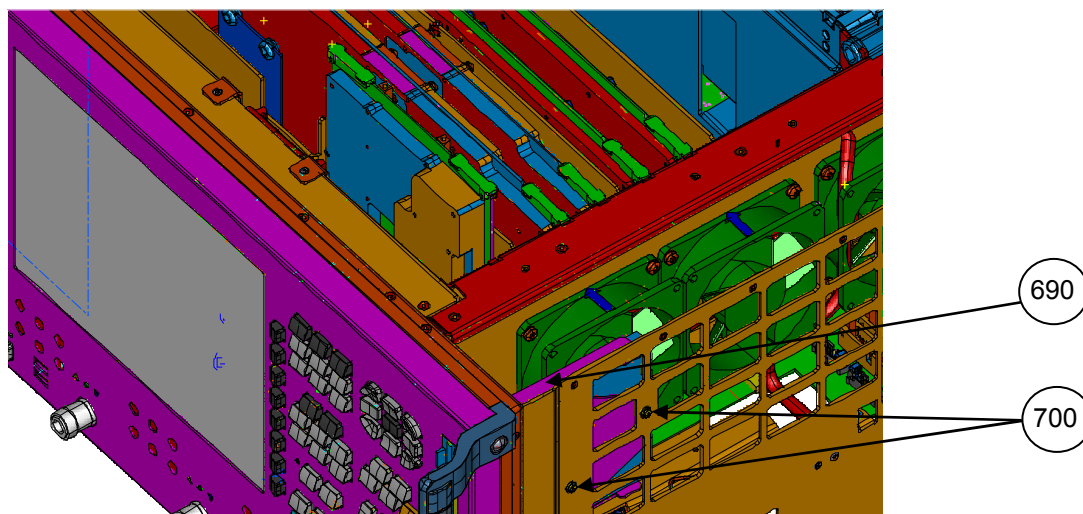
- Prior to modification, the instrument - specific data should be stored on a USB drive.
- Copy the files "Factory.cal" and "Factory.dat" from
C:\Documents and Settings\All Users\Application Data\Rohde&Schwarz\Nwa\Data\calibration
to an USB drive.

Disassembling the Unit

- For disassembling see chapter **Replacing Front Modul Controller A90**.

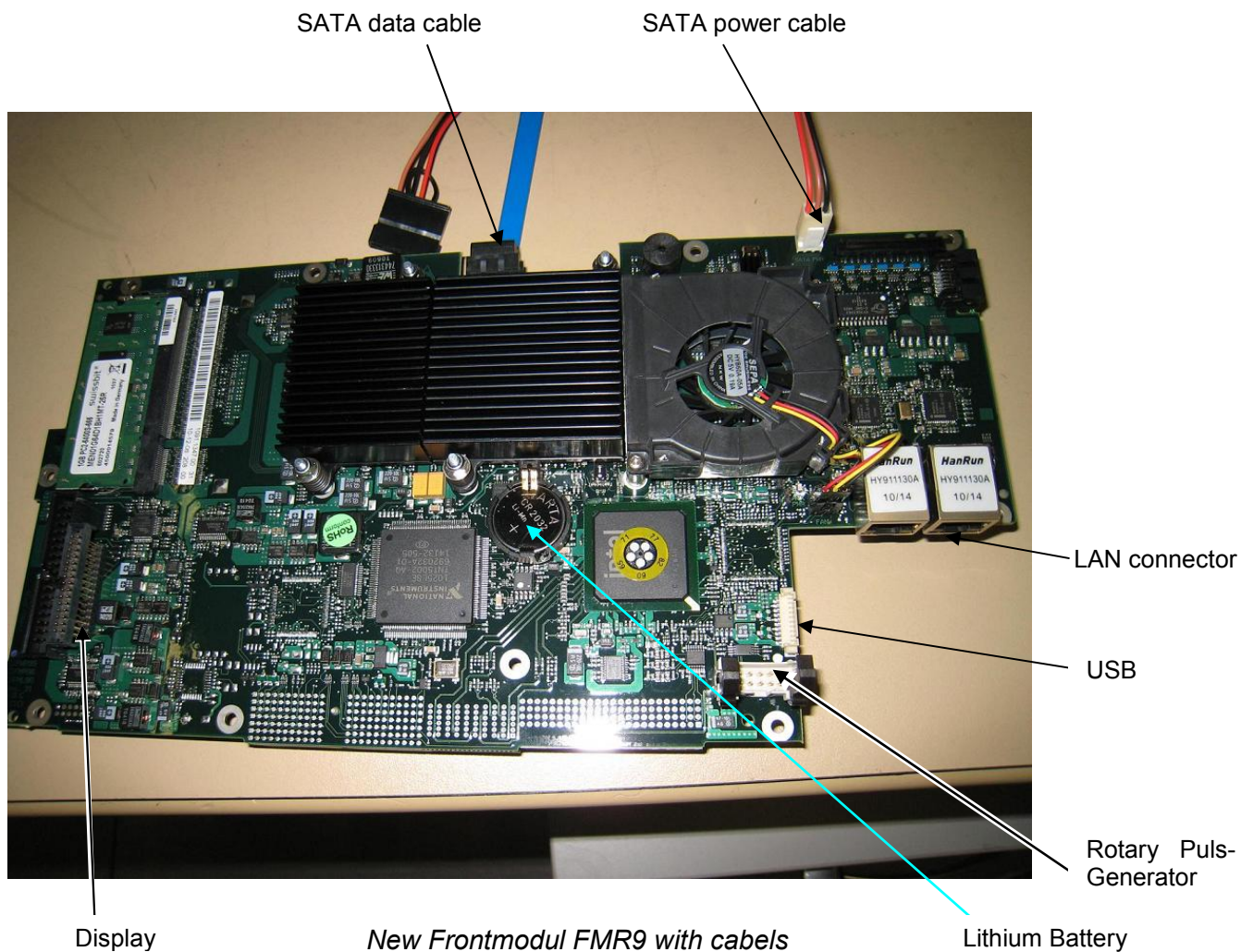
Remove the Floppy Disk Drive

- Disconnect floppy flex strip cable W300(690) from X30 of motherboard
- Undo 2 screws and washers (700) on instrument frame remove floppy disk drive (670)
- Mount the new cover (1312.7627.00) by using screws(700) on the same position



Installing the new front module controller and putting the instrument back together

- Disconnect all cables from the FMR7/x unit (2*LAN, USB, SATA), remember the position from the 2 LAN cables, they must be connected with the same connector like the FMR7/x unit
- Disassembly the FMR7 by unscrewing (590)
- Assembly the FMR9/6 with 9 screws (590)



- Connect cables (USB, 2 *LAN, SATA data (use right SATA connector), SATA power) and install them like picture 3
- Fit the instrument top cover (296) and secure it with all countersunk screws (299).
- Mount the new Cover 1312.7627.00 and fasten it with the screws (700)
- Reconnect cables for the DISPLAY unit, USB, two Flexible Switch Foils and the cable from Rotary Puls-Generator
- For the next steps see chapter Replacing Front Modul Controller A90

Putting into operation

Firmware

- Perform an Analyzer BIOS update for FMR9 (see <https://gloris.rohdeschwarz.com>, Document link: Firm- \ Software)
- Perform a HD recovery using ZVABT Recovery CD FMR9
After reboot, switch analyzer application screen to windows screen.
Use windows explorer to browse and search the batch file to configure the display type.
Select and execute C:\Display\Tools\image_set_601.bat.
Reboot
- Perform a firmware update.
- Download from <http://www.rsd.de/>
Select Downloads → Select your product: "ZVA" and mark "Firmware" → Go
Firmware Version 2.81 or higher is necessary.
Netcon PCINT FPGA Version 8.5 or higher is necessary.

Restoration of Factory settings

- Switch the unit on by pressing the "Standby" button in front.
- Copy the stored files "Factory.cal" and "Factory.dat" from USB drive to
C:\Documents and Settings\All Users\Application Data\Rohde&Schwarz\Nwa\Data\calibration
- Switch the unit off and on by pressing the "Standby" button in front.
- Select Service Level 2 (see chapter **Service Functions**).
- When the instrument has been started, check the protocol file for errors:
[INFO : Error Log]

Replacing the Lithium Battery on the Front Module Controller

(See Chapter 5, Spare Parts List, Item (582), and drawings 1145.1010, 1145.1290)

The lithium battery is located on the front module controller behind the front unit.

CAUTION

*Do not expose lithium batteries to high temperatures or naked flames.
Keep batteries away from children.*

If the battery is not replaced correctly, there is a risk of explosion. Only use R&S-type replacement batteries (See Chapter 5, Spare Parts List, Item 776 for type FMR6)

Lithium batteries are classified as special waste – only use designated containers for disposal.

Opening the instrument and removing the front unit

- Turn off the instrument and disconnect from the mains supply.
- Remove the 4 screws in the front handles (410), right and left, and take off the front handles
- Remove 3.5 mm connection cables (only with option R&S ZVBx-B16)
- Remove the countersunk screw (390) next to the display and pull off the front cover (300 to 330) forwards.
- Remove the 2 countersunk screws (610) in the top of the front frame and the 2 in the bottom.
- Remove the countersunk screws (176) (4), (177) (6), (178) (8).
- Pull out forwards the front unit together with the keyboard and display (600, 601, 602, 603).

NOTICE

The cables to the front module controller are still connected.

-
- Disconnect the cables to the LCD, the DC/AC illumination converter, the key pad (keyboard), the tachogenerator and, if necessary, the network connection on the front module controller.

Note:

When disconnecting cables, be especially careful with the cable to the keyboard. It is a foil cable and can only be removed when the locking device on the foil-cable connector is released.

Removing the lithium battery

- Carefully lift up and pull out the battery.

Note:

Lithium battery 3.4 V (dia. 20 mm * 3 mm) R&S Item No. 0858.2049.00

Front Module Controller Typ FMR6

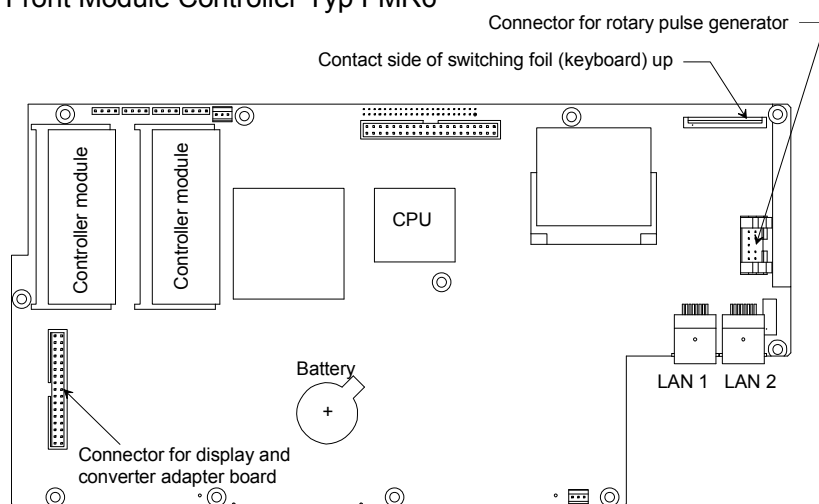


Fig. 3-4 Location of the lithium battery on the front module controller

Installing the new battery and reassembling the instrument

⚠ CAUTION

Never short circuit the battery.

- Insert the battery under the spring in the holder.
N.B.: The positive pole of the battery (+) must be uppermost.
- Reinsert the front unit in the instrument and secure to the front frame with 4 countersunk screws (610).
- Refit the countersunk screws (176) (4), (177) (6), (178) (8).

NOTICE

Avoid trapping cables and ensure cabling is tidy.

- Replace the front cover (300 to 330) and screw in the countersunk screw (390).
- Reconnect the 3.5 mm connection cables (only with option R&S ZVBx-B16).
- Refit the 2 front handles (410) using 4 screws.

Putting into operation

- Connect the mains cable and turn on at the power switch. The instrument is now in standby mode.
- Select Service Level 2 (see Service Functions).
- When the instrument has been started, check the protocol file for errors:
[INFO : Error Log]

Replacing Hard Disk A60

(See Chapter 5, Spare Parts List, Item 710, and drawings 1145.1010 and 1145.1290)

The hard disk is located between the controller tray and the boards. The spare disk is delivered with the software pre-installed.

Before removal:

Whenever possible, back up the user data on an external data storage medium.

Opening the instrument and replacing the hard disk

Turn off the instrument, disconnect from the mains, unscrew the 4 rear-panel feet (460) and pull off the enclosure (400) backwards

- Lift off the instrument cover (296) at the top after undoing the 23 (2 ports) or. 28 (4 ports) countersunk screws (298).
- Disconnect the flat cable (715) at the hard disk drive.

Note:

Do not pull or push on the flat cable – instead, carefully lever out the connector strip with a small screwdriver.

- Remove the 2 countersunk screws (725) in the hard disk holder (720).
- Remove the hard disk (710) and holder (720).
- Undo the 4 countersunk screws (730), remove the old hard disk and screw the new hard disk to the holder (720).

Installing and putting the new hard disk into operation

- Refit the hard disk and holder into the instrument using 2 countersunk screws (725).

Note:

The bottom of the holder is inserted into a sheet-metal wall.

- Connect the flat cable (715) to the hard disk.
- Replace the instrument's top cover (296) and screw back into position with 23 or 28 countersunk screws (298).
- Slide on the enclosure (400) and screw the 4 rear-panel feet (460) back into position.
- Connect the mains cable and turn on at the mains switch. The instrument is now in standby mode
- Select Service Level 2 (see Service Function)
- When the instrument has been started, check the protocol file for errors:
[INFO : Error Log]
- Perform the factory system error calibration (see **Factory System Error Calibration**).

Replacing LCD A70 and the DC/AC Converter

(See Chapter 5, Spare Parts List Items 910, 930 and drawings 1145.1290, 1145.1384)

The LCD and the associated DC/AC converter are accommodated on a mounting plate. The connection to the front module controller is made with cables which should also be replaced individually. The replacement procedure is as follows:

Opening the instrument and removing the front unit

- Turn off the instrument and disconnect from the mains.
- Remove the 4 screws in the front handles (410), left and right, and take off the front handles.
- Remove 3.5 mm connection cables (only with option R&S ZVBx-B16)
- Remove the countersunk screw (390) next to the display and pull off the front cover (300 to 330) forwards.
- Remove the 2 countersunk screws 610) in the top of the frame and the 2 in the bottom.
- Remove the countersunk screws (176) (4), (177) (6), (178) (8).
- Pull out the front unit together with the keyboard and display (600, 601, 602, 603) forwards.

NOTICE

The cables to the front module controller are still connected.

- Disconnect the cables to the LCD, the DC/AC illumination converter, the key pad (keyboard), the tachogenerator and, if necessary, the network connection to the front module controller.

Note:

When disconnecting cables, be especially careful with the cable to the keyboard. It is a foil cable and can only be removed when the locking device on the foil-cable connector has been released.

Place the key-side of the front unit on a clean surface.

Removing the DC/AC converter

- Disconnect the cable from the display (910) to the DC/AC converter (930).
- Disconnect the converter cable (950) to the DC/AC converter (930)
- Remove the DC/AC converter (930) by undoing the 2 screws (940)

Removing the LCD

- Disconnect the display cable (945) by cutting through the adhesive label(946).
- Remove the display connector (1020) after you have undone the two screws (1040).
- Disconnect the display cable (1030) at the display (910).
- Remove the display (910) after removing the 4 screws (920)

Installing and putting into operation a new LCD or DC/AC converter

- Reinstall the new LCD or new DC/AC converter by reversing the disassembly procedure, refit all screws and reconnect the cables that have been disconnected (drawing 1145.1384).
- When replacing the display (921) or display cable (945), use a new adhesive label (946) to secure the cabling.
- Place the key-side of the front unit on the top of the instrument so that the cables can be connected to the front module controller.
- Carefully connect all cable connectors to the front module controller, ensuring that the polarity is correct.

Front Module Controller Typ FMR6

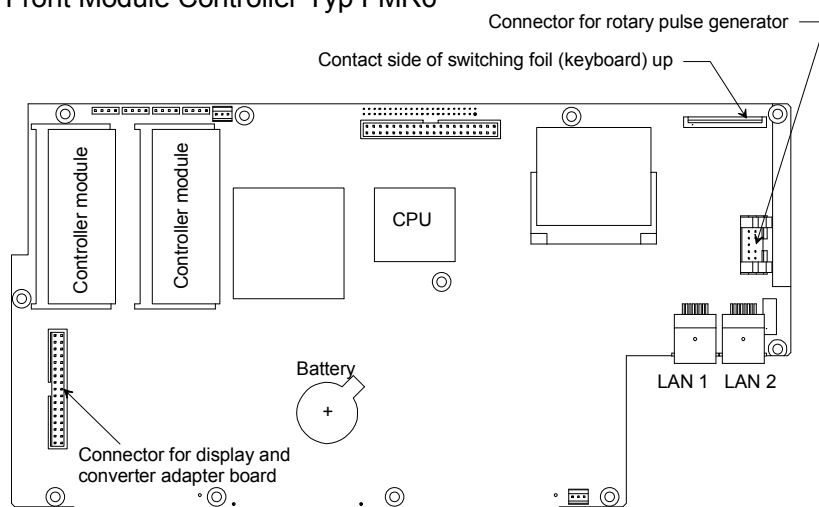


Fig. 3-5 Location of the edge contacts on the front module controller

- Reinsert the front unit in the instrument and secure to the front frame with 4 countersunk screws (610).
- Refit the countersunk screws (176) (4), (177) (6), (178) (8).

NOTICE

Avoid trapping cables and ensure cabling is tidy.

- Replace the front cover (300 to 330) and secure with countersunk screw (390).
- Reconnect the 3.5 mm connection cables (only with option R&S ZVBx-B16)
- Refit the 2 front handles (410) using the 4 screws.
- Connect the mains cable, turn on at the mains switch and press the ON key.

Replacing Flexible switch board (Keyboard) A16 / Key Pad A15

(See Chapter 5, Spare Parts List, Items 860, 870, 875, 877 and drawings 1145.1010, 1145.1384)

The flexible switch board (keyboard) and key pad are located behind the front cover and the keyboard frame.

Opening the instrument and removing the front unit

- Turn off the instrument and disconnect from the mains.
- Remove the 4 screws in the front handles (410), right and left, and take off the front handles
- Remove 3.5 mm connection cables (only with option R&S ZVBx-B16)
- Remove the countersunk screw (390) next to the display and pull off the front cover (300 to 330) forwards.
- Remove the 2 countersunk screws (610) in the top of the front frame and the 2 in the bottom.
- Remove the countersunk screws (176) (4), (177) (6), (178) (8).
- Pull out the front unit together with the keyboard and display (600, 601, 602, 603) and place it with the key-side on top of the instrument.

NOTICE

The cables to the front module controller are still connected.

- Disconnect the cables to the LCD, the DC/AC illumination converter, the key pad (keyboard), the tachogenerator and, if necessary, the network connection to the front module controller.

Note:

When disconnecting cables, be especially careful with the cable to the keyboard. It is a foil cable and can only be removed when the locking device on the foil-cable connector is released.

Removing the flexible switch board (keyboard) / key pad

- Place the front unit with the key-side upwards on a clean surface.
- Remove knob (990) from the tachogenerator.
- Undo the 10 countersunk screws (890) and remove the keyboard frame (800, 801, 805).
- The flexible switch board (860) and the key pad (870, 875) can now be replaced.

Installing a new flexible switch board / key pad and reassembling the instrument

- Insert the new flexible switch board (860) into the keyboard frame (800, 801, 805) from behind.

N.B.: The positioning pins must be inserted in the holes in the keyboard frame.

- Place the new key pad (870, 875) on the rear of the flexible switch board (860).

Note:

Thread the foil cable's connector through the slot in the mounting tray.

Position the key pad so that the pins on the flexible switch board pass through the holes in the key pad.

- Place the rear of the display unit on the key pad (870, 875).

N.B.: *Position the display unit so that the pins on the flexible switch board pass through the holes in the mounting tray.*

- Press the front unit together, with the key-side upwards turn and screw back together again with 10 countersunk screws (890).
- Place the front unit with the key-side on top of the instrument so that the cables can be connected to the front module controller
- Reconnect the cables to the front module controller, ensuring correct polarity.

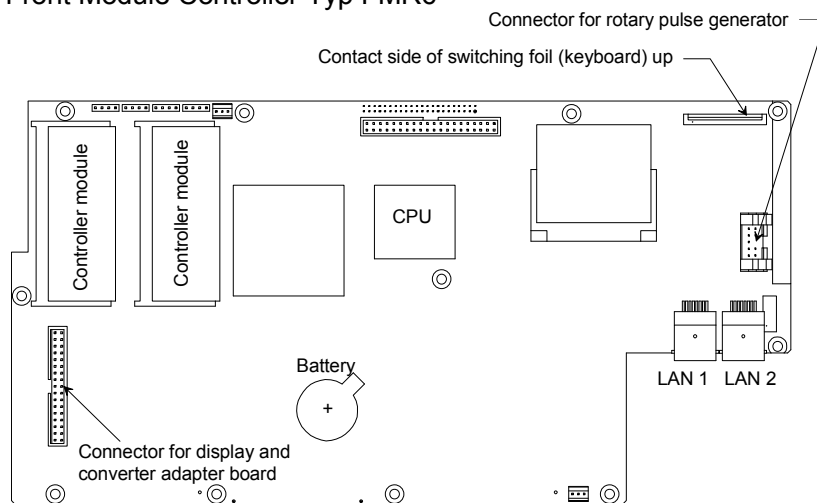
Front Module Controller Typ FMR6

Fig. 3-6 Location of the edge contacts on the front module controller

- Reinsert the front unit into the instrument and secure to the front frame with 4 countersunk screws (610).
- Refit the countersunk screws (176)(4), (177) (6), (178) (8).

NOTICE

Avoid trapping cables and ensure cabling is tidy.

- Replace the front cover (300 to 330) and secure with the countersunk screw (390).
- Reconnect the 3.5 mm connection cables (only with option R&S ZVBx-B16)
- Refit the 2 front handles (410) using 4 screws.
- Connect the mains cable, turn on at the mains switch and press the ON key.

Replacing the Front Cover

(See Chapter 5, Spare Parts List, Items 300, 303, 306, 310, 313, 316, 317, 318, 320, 323, 324, 327, 328, 330 and drawing 1145.1010)

The front cover is the outermost front panel with lettering. Each instrument type has its own front cover.

- Turn off the instrument and disconnect from the mains.
- Remove the 4 screws in the front handles (410), right and left, and take off the front handles
- Remove 3.5 mm connection cables (only with option R&S ZVBx-B16)
- Remove the countersunk screw (390) next to the display and pull off the front cover (e.g. 300) forwards
- Fit the new front cover and reassemble the instrument by reversing the disassembly procedure.
- Connect the mains cable, turn on at the mains switch and press the ON key.

Replacing Disk Drive A30

(See Chapter 5, Spare Parts List, Item 670 and drawing 1145.1290)

Opening the instrument and removing the disk drive

- Turn off the instrument and disconnect from the mains, screw off the 4 rear-panel feet (460) and pull off the enclosure (400) backwards.
- Remove the 2 sems screws (700) and carefully lift out the floppy disk drive (670), together with the floppy disk holder (680).

N.B.: *The floppy cable to the motherboard is still connected.*

- Disconnect floppy cable (690) on the floppy disk drive.

Installing a new disk drive and reassembling the instrument

- Release the floppy disk drive by removing the 3 sems screws (702) from the floppy drive holder (680) and insert a new floppy disk drive (670) into the floppy drive holder (680).
- Connect floppy cable (690) on the floppy disk drive.
- Resecure the floppy disk drive (680) from above to the side of the instrument with the fan using 2 sems screws (700).

N.N.: *Center the floppy disk drive wrt the cut-out in the front cover.*

- Slide the enclosure (400) back on and screw the 4 rear-panel feet (460) into position.
- Connect the mains cable, turn on at the mains switch and press the ON key.

Function test

- The instrument boots up and starts the instrument firmware.
- Insert a 3 ½ "disk with files.
- Press the FILE key, then the File Manager softkey and Edit Path.
- Enter " a " and " : " with the screen functions and terminate with the Enter key.
- The directory structure of the disk displayed on the screen shows that the floppy disk drive is operating properly.

Replacing USB Board A40

(See Chapter 5, Spare Parts List, Item 1050 and drawings 1145.1290 and 1145.1384)

The USB board is located behind the front cover and the keyboard frame next to the ON key.

Opening the instrument and removing the USB-board

- Turn off the instrument and disconnect from the mains.
- Remove the 4 screws in the front handles (410), right and left, and take off the front handles
- Remove 3.5 mm connection cables (only with option R&S ZVBx-B16)
- Remove the countersunk screw (390) next to the display and pull off the front cover (300 to 330) forwards.
- Remove the 2 countersunk screws (610) in the top of the front frame and the 2 in the bottom.
- Remove the countersunk screws (176) (4), (177) (6), (178) (8).
- Pull out the front unit together with the keyboard and display (600, 601, 602, 603) forwards and place it with the key side on top of the instrument.

Remove the 2 screws (1060), disconnect the cable and remove the USB board (1050).

Fitting the USB board and reassembling the instrument

- Install the new USB board by reversing the removal procedure, replace all screws and connect and install the relevant cables (drawing 1145.1384).
- Insert the front unit back into the instrument and secure to the front frame with 4 countersunk screws (610).
- Refit the countersunk screws (176)(4), (177) (6), (178) (8).
- Replace the front cover (300 to 330) and secure with the countersunk screw (390).
- Reconnect the 3.5 connection cables (only with option R&S ZVBx-B16)
- Refit the 2 front handles (410) using 4 screws.
- Connect the mains cable, turn on at the mains switch and press the ON key.
- Check the USB board: Connect the mouse or keyboard and perform a function check.

Replacing Power Supply A20

(See Chapter 5, Spare Parts List, Items 790 and drawings 1145.1010, 1145.1290)

The power supply is installed at the rear of the instrument frame.

Removing the power supply

- Turn off the instrument and disconnect from the mains, screw off the 4 rear-panel feet (460) and pull off the enclosure (400) towards the rear.
- Remove the 2 countersunk screws (796) in the top of the instrument and the 8 sems screws. (795) in the rear panel of the power supply.
- Pull out the power supply unit a little at the rear of the instrument, remove screw (737) and anti-touch guard (736).
- On the left-hand side of the power supply, pull off the protective conductor cable and fuse board (735) to the left.
- On the right-hand side of the power supply, remove the plug-on connections to the motherboard.
- Remove the power supply unit.
- Remove the 4 screws (793) and washers (792) and remove the power supply (790) from the power supply plate (791).

Installing the new power supply

- Fit the new power supply by reversing the removal procedure.
- Push the enclosure (400) back on and screw the 4 rear-panel feet (460) into position.
- Connect the mains cable, turn on at the mains switch and press the ON key.
- Select Service Level 2 (see Service Functions).
- When the instrument has been started, check the protocol file for errors
[INFO : Error Log]

Replacing Fuse board A21

(See Chapter 5, Spare Parts List, Item 735, and drawings 1145.1010, 1145.1290)

The fuse board is installed on the left-hand side of the power supply.

Removing the power supply and the fuse board

- Turn off the instrument and disconnect from the mains, screw off the 4 rear-panel feet (460) and pull off the enclosure (400) backwards.
- Remove the 2 countersunk screws (796) in the top of the instrument and the 8 semi screws. (795) in the rear panel of the power supply.
- Pull out the power supply unit a little at the rear of the instrument, remove screw (737) and anti-touch guard (736).
- On the left-hand side of the power supply, pull off the fuse board (735) to the left.
- Disconnect the two mains cables from the fuse board.

Fitting the new fuse board and the power supply

- Connect the mains cables to the fuse board and refit the fuse board to the power supply.
- Secure the anti-touch guard (736) with screw (737).
- Reinstall the power supply by reversing the removal procedure.
- Push the enclosure (400) back on and screw the 4 rear-panel feet (460) into position.
- Connect the mains cable, turn on at the mains switch and press the ON key.
- Select Service Level 2 (see Service Functions).
- When the instrument has been started, check the protocol file for errors
[INFO : Error Log]

Replacing a Fan

(See Chapter 5, Spare Parts List, Item 15 and drawings 1145.1010, 1145.1290, 1145.1332)

The fans, three in all, are located behind the right-hand side panel.

Opening the instrument and removing the fan

- Turn off the instrument and disconnect from the mains, screw off the 4 rear-panel feet (460) and pull off the enclosure (400) backwards.
- Lift off the top instrument cover (296) after undoing the 23 (2 ports) or 28 (4 ports) countersunk screws (298).
- Remove the 4 screws in the front handles (410), right and left, and take off the front handles.
- Remove 3.5 mm connection cables (only with option R&S ZVBx-B16)
- Remove the countersunk screw (390) next to the display and pull off the front cover (300 to 330) forwards
- Remove the 2 countersunk screws (610) in the top of the front frame and the 2 in the bottom.
- Remove the countersunk screws (176) (4), (177) (6), (178) (8)
- Pull out the front unit together with the keyboard and display (600, 601, 602, 603) forwards.
- Disconnect the fan cable on the motherboard X35, X36 and X37 (FAN).
- Undo the 2 screws (19) and the 5 screws (17) and remove fan plate (50) with the 3 fans (15).
- Remove fan (15) by undoing the 4 fan screws (18).

Fitting a new fan and reassembling the instrument

- Install the fan using the 4 fan screws.
N.B.: *The arrows on the fan show the installation position. The fan blows air into the instrument. Route the fan cable so that it cannot get caught in the fan.*
- Reinsert the fan plate with the 3 fans on it into the instrument and secure with 2 screws (19) and 5 screws (17).
- Connect the fan cabling on the motherboard X35, X36 and X37 (FAN).
- Reinsert the front unit into the instrument and secure to the front frame with 4 countersunk screws (610).
- Refit the countersunk screws (176) (4), (177) (6), (178) (8).

NOTICE

Avoid trapping cables and ensure cabling is tidy.

- Replace the front cover (300 to 323) and secure with the countersunk screw (390).
- Reconnect the 3.5 mm connection cables (only with option R&S ZVBx-B16)
- Refit the 2 front handles (410) using 4 screws.
- Refit the top instrument cover (296) with 23 (2 ports) or 28 (4 ports) countersunk screws (298).
- Connect the mains cable, turn on at the mains switch and press the ON key.

- Check that all three fans are operating correctly (fans are blowing air into the instrument).
- Turn off the instrument and disconnect the mains cabling again.
- Push the enclosure (400) back on and screw the 4 rear-panel feet (460) into position.
- Connect the mains cable, turn on at the mains switch and press the ON key.

Replacing Motherboard A10

(See Chapter 5, Spare Parts List, Item 510 and drawings 1145.1010, 1145.1290)

The motherboard is located on the base of the instrument.

N.B.: *The motherboard can only be replaced at R&S service centers.*

Opening the instrument and removing the motherboard

- Turn off the instrument and disconnect from the mains, screw off the 4 rear-panel feet (460) and pull off the enclosure (400) backwards.
- Lift off the top instrument cover (296) after undoing the 23 (2 ports) or 28 (4 ports) countersunk screws (298).
- Extract the top boards: Use ejector lever for the synthesizer and network controller, hold the frequency reference by the enclosure.
- Remove the power supply (550).
 - Remove the 2 countersunk screws (796) in the top of the instrument and the 8 screws (795) in the rear panel of the power supply.
 - Pull out the power supply unit a little at the rear of the instrument, remove screw (737) and anti-touch guard (736).
 - On the left-hand side of the power supply, pull off the protective conductor cable and the fuse board (735) to the left.
 - On the right-hand side of the power supply, pull off the plug-in connections to the motherboard.
 - Remove the power supply unit.
- Remove the 4 screws in the front handles (410), right and left, and take off the front handles.
- Remove 3.5 mm connection cables (only with option R&S ZVBx-B16)
- Remove the countersunk screw (390) next to the display and pull off the front cover (300 to 330) forwards.
- Remove the 2 countersunk screws (610) in the top of the front frame and the 2 in the bottom.
- Remove the countersunk screws (176) (4), (177) (6), (178) (8).
- Pull out the front unit together with the keyboard and display (600, 601, 602, 603) forwards.

NOTICE

The cables to the front module controller are still connected.

- Disconnect the cables to the LCD, the DC/AC illumination converter, the key pad (keyboard), the tachogenerator and, if necessary, the network connection to the front module controller.

Note:

When disconnecting cables, be especially careful with the cable to the keyboard. It is a foil cable and can only be removed when the locking device on the foil-cable connector is released.

- Remove the front module controller (for instructions see “Replacing Front Module Controller A90”)
- Place the instrument on its top and remove the instrument’s base cover (297) by undoing the 12 countersunk screws (299).
- Undo the RF cabling from the reflectometers (165, 170, 175) to the LO divider (125) and to the motherboard.
- Release the 50-pin flat cable and disconnect from the reflectometers
- Remove screws (151, 156, 161) and take out the reflectometers.
- Undo RF cabling at the LO divider (125).
- Disconnect the 12-pin flat cable from the LO divider
- Remove screws (127) (2 in the strut, 4 in the rear panel) and take out the LO divider together with plate (126)

Undo the screws holding the connectors on the rear panel:

- The 6 hexagonal nuts and washers for the BNC connectors.
 - 2 hexagonal bolts (530, 540) each for the monitor interface and the user-control interface.
 - 2 hexagonal screws (550) each for the USB interface and in the dummy panel (555).
- Remove the 3 screws (144) each for the left and right side panels and the 2 screws (143) in the center and take out both motherboard rails (140, 141).
 - Disconnect any cabling still on the motherboard (fan, floppy, IEC-bus, etc.).
 - Remove the 14 screws holding the motherboard (520) and take out the motherboard.

Installing the motherboard and reassembling the instrument

N.B.: *The motherboard is the passport of the instrument and unique for every unit.
The Eprom on the motherboard contains the serial No. of the instrument.
Pre-configured motherboards are not available.*

- Install the new motherboard by reversing the removal procedure.

N.B.: *Install the motherboard carefully to prevent any damage to components.
Lettering indicates where cables are to be connected.*

- Reinstall the front module controller, front unit, power supply, boards and cables, instrument covers, enclosure and rear-panel feet by reversing the disassembly procedure.
- Connect the mains cable, turn on at the mains switch and press the ON key.
- For writing motherboard data to the Eprom please contact the service center in Munich.
- Select Service Level 2 (see Service Functions).
- Check the protocol file for errors: [INFO : Error Log]
- Align the DC inputs (see **Aligning the DC Inputs**)
- Write synthesizer mapping and shift data to the motherboard Eprom (see **Correction Value Recording**)

Replacing a Reflectometer RM8 A510 to 540

(See Chapter 5, Spare Parts List, Items 165, 170, 175 and drawing 1145.1010)

The boards are located under the motherboard.

Opening the instrument and removing the board

- Turn off the instrument and disconnect from the mains, screw off the 4 rear-panel feet (460) and pull off the enclosure (400) backwards.
- Remove the bottom instrument cover (297) after undoing the 12 countersunk screws (299).
- Remove the 4 screws in the front handles (410), right and left, and take off the front handles.
- Remove the countersunk screw (390) next to the display and pull off the front cover (300 to 330) forwards
- Remove the 2 screws (176, 177, 178) in the front of the instrument next to the port connector.
- Disconnect the source cable, the LO cable, the two IF cables and the 50-pin control cable from the reflectometer.
- Remove the 2 screws (151, 156, 161) at the end of the reflectometer and take out the reflectometer

Installing the board and reassembling the instrument

- Insert the new board into the instrument and reconnect any cables that have been disconnected

N.B.: Use the lettering on the motherboard as an aid.

- Screw in the 2 screws (176, 177, 178) in the front of the instrument next to the port connector.
- Screw in the 2 screws (151, 156, 161) in the end of the reflectometer.
- Fit the instrument base cover (297) and secure with 12 countersunk screws (299).
- Replace the front cover (300 to 323) and secure with the countersunk screw (390).
- Refit the 2 front handles (410) using 4 screws.
- Slide the enclosure (400) back on and screw the 4 rear-panel feet (460) into position.
- Connect the mains cable and turn on at the mains switch. The instrument is now in the standby mode.
- Select Service Level 2 (see Service Functions).
- When the instrument has been started, check the protocol file for errors:
[INFO : Error Log]
- Record the generator and receiver correction data (see **Recording Correction Values**).
- Perform the factory system error calibration (see **Factory System Error Calibration**).

Replacing Generator Board (R&S ZVB4/8 only)

(See Chapter 5, Spare Parts List, Item 110 and drawing 1302.4960.08)

Opening the instrument and removing the board

- Remove the Reflectometer (see chapter **Replacing a Reflectometer RM8 A510 to A540**)
- Remove the cover (130)
- Remove the fan cable
- Pull off the Generator Board (110)

Installing the board and reassembling the instrument

- Fit the new Generator Board (110)
- Reconnect the fan cable
- Fit the cover (130)
- Reinstall the Reflectometer (see chapter **Replacing a Reflectometer RM8 A510 to A540**)
- Connect the mains cable and turn on at the mains switch. The instrument is now in the standby mode
- Select Service Level 2 (see Service Functions).
- When the instrument has been started, check the protocol file for errors:
[INFO : Error Log]
- Record the generator and receiver correction data (see **Recording Correction Values**).
- Perform the factory system error calibration (see **Factory System Error Calibration**).

Replacing Receiver Board (R&S ZVB4/8 only)

(See Chapter 5, Spare Parts List, Item 120, 125 and drawing 1302.4960.08)

Opening the instrument and removing the board

- Remove the Reflectometer (see chapter **Replacing a Reflectometer RM8 A510 to A540**)
- Remove the cover (150)
- Pull off the Receiver Board (120, 125)

Installing the board and reassembling the instrument

- Fit the new Receiver Board (120, 125)
- Fit the cover (150)
- Reinstall the Reflectometer (see chapter **Replacing a Reflectometer RM8 A510 to A540**)
- Connect the mains cable and turn on at the mains switch. The instrument is now in the standby mode
- Select Service Level 2 (see Service Functions).
- When the instrument has been started, check the protocol file for errors:
[INFO : Error Log]
- Record the generator and receiver correction data (see **Recording Correction Values**).
- Perform the factory system error calibration (see **Factory System Error Calibration**).

Replacing Generator and Receiver Cover (R&S ZVB4/8 only)

(See Service Circular 10028 and Chapter 5, Spare Parts List, Items 130, 150 and drawing 1302.4960.08)

Opening the instrument and removing the cover

- Remove the Reflectometer (see chapter **Replacing a Reflectometer RM8 A510 to A540**)
- Remove the RM mount (200), 4 Screws (210)
- Remove the covers (130, 150)

Installing the cover and reassembling the instrument

- Fit the new covers (130, 150)
- Refit the RM mount (200)
- Reinstall the Reflectometer (see chapter **Replacing a Reflectometer RM8 A510 to A540**)
- Connect the mains cable and turn on at the mains switch. The instrument is now in the standby mode
- Select Service Level 2 (see Service Functions).
- When the instrument has been started, check the protocol file for errors:
[INFO : Error Log]
- Record the receiver correction data (see **Recording Correction Values**).
- Perform the factory system error calibration (see **Factory System Error Calibration**).

Replacing the Inner Conductor of a Port Connector (R&S ZVB4/8 only)

(See Chapter 5, Spare Parts List, Item 110, and drawings 1145.1010, 1145.3593, 1145.3664)

Opening the instrument and removing the reflectometer

- Remove the Reflectometer (see chapter **Replacing a Reflectometer RM8 A510 to A540**)

Replacing the inner conductor

- Unscrew the N outer conductor with a spanner (narrow, SW 14 mm) and take out inner conductor unit.
N.B.: Ensure that the centring disk (135) is also removed.
- Carefully insert the new inner conductor in the bridge unit enclosure and screw back the N outer-conductor (lock with Loctite 262, mount with torque 3.5 Nm).

Reassembling the instrument

- Reinstall the Reflectometer (see chapter **Replacing a Reflectometer RM8 A510 to A540**)
- Connect the mains cable and turn on at the mains switch. The instrument is now in standby mode.
- Select Service Level 2 (see Service Functions).
- When the instrument has been started, check the protocol file for errors:
[INFO : Error Log]
- Perform factory system error calibration (see **Factory System Error Calibration**).

Replacing the Bridge Unit (R&S ZVB4/8 only)

(See Chapter 5, Spare Parts List, drawings 1145.1010, 1145.3664, Item 100)

Opening the instrument and removing the reflectometer

- Remove the Reflectometer (see chapter **Replacing a Reflectometer RM8 A510 to A540**)

Removing the bridge unit

- Loosen the MEAS, REF and GEN cables (310, 320, 300) at both ends and disconnect at the bridge unit.

***N.B.:** When loosening support the cable with a 7 mm spanner!*

- Remove the 3 screws (160) and carefully pull the bridge unit off the reflectometer.
- Remove the 2 screws (240) and remove the plate (230).

Fitting the new bridge unit

- Secure plate (230) to the new bridge unit using the 2 screws (240).
- Carefully place the bridge unit on the reflectometer and secure with 3 screws (160).
- Screw the MEAS- REF and GEN cables (310, 320, 300) to the bridge unit, and then tighten at both ends.

***N.B.:** When tightening with a 7 mm spanner support the cable.*

Reassembling the instrument

- Reinstall the Reflectometer (see chapter **Replacing Reflectometer RM8 A510 to A540**)
- Connect the mains cable and turn on at the mains switch. The instrument is now in standby mode
- Select Service Level 2 (see Service Functions).
- When the instrument has been started, check the protocol file for errors:
[INFO : Error Log]
- Record generator and receiver correction data (see **Recording Correction Data**).
- Perform factory system error calibration (see **Factory System Error Calibration**).

Replacing a Reflectometer RM20 A510 to 540

(See Chapter 5, Spare Parts List, Items 180, 185, 190 and drawings 1145.1010, 1302.4425)

The boards are located under the motherboard.

Opening the instrument and removing the board

- Turn off the instrument and disconnect from the mains, screw off the 4 rear-panel feet (460) and pull off the enclosure (400) backwards.
- Remove the bottom instrument cover (297) after undoing the 12 countersunk screws (299).
- Disconnect the 3 cables to the coupler, the LO cable, the two IF cables and the 50-pin control cable from the reflectometer (in case of Mod. 22 this is also necessary for the second reflectometer of the associated 2RM unit).
- R&S ZVB14 mod. 14 and 19, R&S ZVB20 mod. 20 and 25: Remove the screws (232) and take off the cover (230).
- R&S ZVB14 mod. 14 and 17, R&S ZVB20 mod. 20, 21 and 23, R&S ZVB14 mod. 19 (port 3 and 4), R&S ZVB20 mod. 25 (port3 and4): Remove the screws (210, 215 or 246, 248)) and take out the reflectometer.
- R&S ZVB20 mod. 22: Remove the screws (210), take out the complete 2RM unit and remove the screws (90).
- R&S ZVB14 mod. 19 (port1 and 2), R&S ZVB20 mod. 25 (port1 and 2): Remove the reflectometer for port1 (port2).
Then remove the screws (210) and take out the reflectometer.

Installing the board and reassembling the instrument

- Insert the new reflectometer into the instrument by reversing the removal procedure and reconnect any cables that have been disconnected
- Fit the instrument base cover (297) and secure with 12 countersunk screws (299).
- Slide the enclosure (400) back on and screw the 4 rear-panel feet (460) into position.
- Connect the mains cable and turn on at the mains switch. The instrument is now in the standby mode.
- Select Service Level 2 (see Service Functions).
- When the instrument has been started, check the protocol file for errors:
[INFO : Error Log]
- Record the generator and receiver correction data (see **Recording Correction Values**).
- Perform the factory system error calibration (see **Factory System Error Calibration**).

Replacing the Coupler Unit (R&S ZVB14/20 only)

(See Chapter 5, Spare Parts List, drawing 1145.1010, item 200)

Opening the instrument and removing the coupler

- Turn off the instrument and disconnect from the mains, screw off the 4 rear-panel feet (460) and pull off the enclosure (400) backwards.
- Remove the instrument base cover (297) after undoing the 12 countersunk screws (299).
- Remove the 4 screws in the front handles (410), right and left, and take off the front handles
- Remove 3.5 mm connection cables (only with option R&S ZVBx-B16)
- Remove the countersunk screw (390) next to the display and pull off the front cover forwards
- Disconnect the 3 RF cables and the bias cable from the coupler
- Remove the 4 screws (181, 186, 220) in the front of the instrument next to the port connector and take out the coupler.

Fitting the new coupler unit and reassembling the instrument

- Insert the coupler into the instrument and screw in the 4 screws (181, 186, 220).
- Reconnect the 3 RF cables and the bias cable.
- Fit the instrument base cover (297) and secure with 12 countersunk screws (299).
- Refit the front cover and screw in the countersunk screw (390).
- Refit the front handles (410).
- Refit 3.5 mm connection cables (only with option R&S ZVBx-B16)
- Push the enclosure (400) back on and screw the 4 rear-panel feet (460) into position.
- Connect the mains cable and turn on at the mains switch. The instrument is now in standby mode
- Select Service Level 2 (see Service Functions).
- When the instrument has been started, check the protocol file for errors:
[INFO : Error Log]
- Record generator and receiver correction data (see **Recording Correction Data**).
- Perform factory system error calibration (see **Factory System Error Calibration**).

Replacing the Reflectometer Fan

(See Chapter 5, Spare Parts List, Item 80, 190 and drawings 1145.1010, 1145.3664, 1145.4277)

- Remove the Reflectometer (see chapter **Replacing a Reflectometer RMxx A510 to A540**)

Replacing the fan

- Disconnect the fan cable at the reflectometer.
- Undo the 4 holding screws (90,194) and remove the fan.
- Insert the new fan (cable outlet to the outside).
- Screw back the 4 screws (90, 194) and washers (100, 192, 193).

Reassembling the instrument

- Reinstall the Reflectometer (see chapter **Replacing a Reflectometer RMxx A510 to A540**)
- Connect the mains cable, turn on at the mains switch and press the ON key.
- Check that the fan is operating.
- Turn off the instrument again and disconnect from the mains.
- Fit the instrument base cover (297) and secure with 12 countersunk screws (299).
- Push the enclosure (400) back on and screw the 4 rear-panel feet (460) into position.
- Reconnect the mains cable and turn on at the mains switch. The instrument is now in the standby mode.

Replacing Network Controller Board A130, A140

(See Chapter 5, Spare Parts List, Items 100, 105 and drawing 1145.1010)

The board is in the upper section of the instrument.

Opening the instrument and removing the board

- Turn off the instrument and disconnect from the mains, screw off the 4 rear-panel feet (460) and pull off the enclosure (400) backwards.
- Lift off the instrument top cover (296) after undoing the 23 (2 ports) or 28 (4 ports) countersunk screws (298).
- Extract the network controller using the ejector lever

Fitting the board and reassembling the instrument

- Fit the new board in the instrument.
- Refit the top instrument cover (296) with 23 (2 ports) or 28 (4 ports) countersunk screws (298).
- Slide the enclosure (400) back on and screw the 4 rear-panel feet (460) into position.
- Connect the mains cable and turn on at the mains switch. The instrument is now in the standby mode
- Select Service Level 2 (see Service Functions).
- When the instrument has been started, check the protocol file for errors:
[INFO : Error Log]
- Record the receiver correction data (see **Recording Correction Values**).
- Perform factory system error calibration (see **Factory System Error Calibration**).
- Align the DC inputs (see **Aligning the DC Inputs**).

Replacing Synthesizer Board A150, A160

(See Chapter 5, Spare Parts List, Items 110, 111, 112, 113, 115 and drawing 1145.1010)

The board is located in the upper section of the instrument.

N.B.: Synthesizers with part numbers 1145.xxxx or 1300.xxxx are no longer available. In case of defect please contact the Central Service in Munich.

Opening the instrument and removing the board

- Turn off the instrument and disconnect from the mains, screw off the 4 rear-panel feet (460) and pull off the enclosure (400) backwards.
- Lift off the instrument top cover (296) after undoing the 23 (2 ports) or the 28 (4 ports) countersunk screws (298).
- Extract the synthesizer with the ejector lever.

Installing the board and reassembling the instrument

- Insert the new board into the instrument.
- Refit the instrument top cover (296) securing with the 23 (2 ports) or the 28 (4 ports) countersunk screws (298).
- Push the enclosure (400) back on and screw the 4 rear-panel feet (460) into position.
- Connect the mains cable and turn on at the mains switch. The instrument is now in the standby mode.
- Install firmware update, if necessary (version ≥ 1.78).
- Install synthesizer mapping (see **Correction Value Recording**)
- Select Service Level 2 (see Service Functions).
- When the instrument has been started, check the protocol file for errors:
[INFO : Error Log]
- Record the generator and receiver correction data (see **Correction Value Recording**).
- Perform factory system error calibration (see **Factory System Error Calibration**).

Replacing LO Divider A600

(See Chapter 5, Spare Parts List, Item 125 and drawing 1145.1010)

The board is located under the motherboard.

Opening the instrument and removing the board

- Turn off the instrument and disconnect from the mains, screw off the 4 rear-panel feet (460) and pull off the enclosure (400) backwards.
- Remove the instrument base cover (297) after undoing the 12 countersunk screws (299).
- R&S ZVB20: Remove the reflectometer units
- Disconnect the RF cable and the 12 pin control cable from the LO divider.
- Remove the 2 screws (128) and remove the LO divider.

Installing the board and reassembling the instrument

- Insert the new board into the instrument and secure with 2 screws (128).
- Reconnect the RF cable and the 12 pin control cable.
- R&S ZVB20: Reinstall the reflectometer units
- Fit the instrument base cover (297) and secure with 12 countersunk screws (299).
- Push the enclosure (400) back on and screw the 4 rear-panel feet (460) into position.
- Connect the mains cable and turn on at the mains switch. The instrument is now in the standby mode
- Select Service Level 2 (see Service Functions).
- When the instrument has been started, check the protocol file for errors:
[INFO : Error Log]
- Record the receiver correction data (see **Recording Correction Data**).
- Perform factory system error calibration (see **Factory System Error Calibration**).

Replacing Frequency Reference Board A100

(See Chapter 5, Spare Parts List, Item 120 and drawings 1145.1010, 1164.1770)

Opening the instrument and replacing the board

- Turn off the instrument and disconnect from the mains, screw off the 4 rear-panel feet (460) and pull off the enclosure (400) backwards.
- Lift off the instrument top cover (296) after undoing the 23 (2 ports) or the 28 (4 ports) countersunk screws (298).
- Extract the frequency reference board (120).

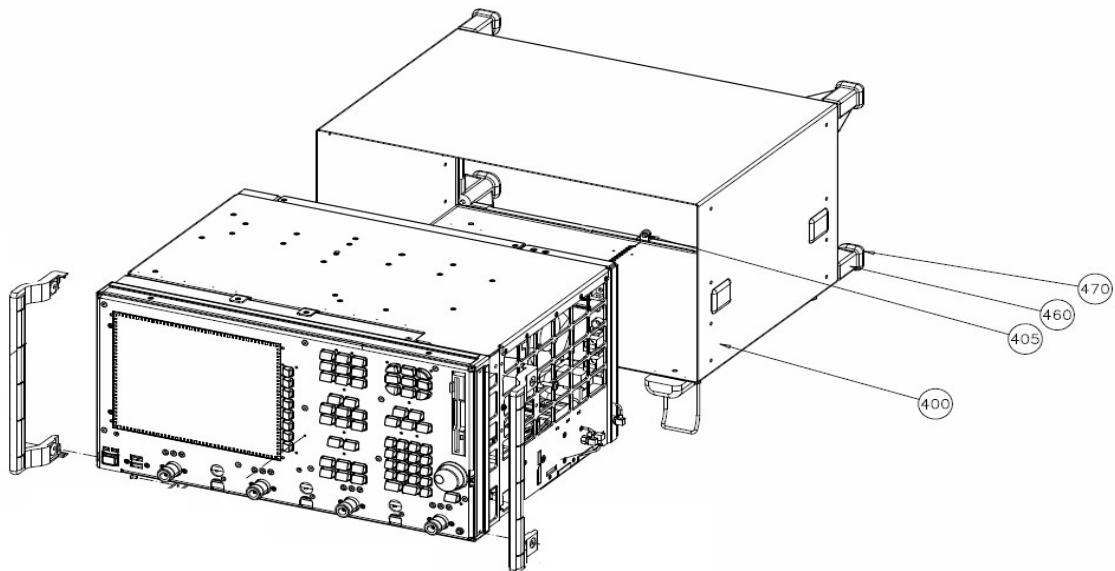
Installing the board and reassembling the instrument

- Insert the new board into the instrument
- Refit the instrument top cover (296) with the 23 (2 ports) or the 28 (4 ports) countersunk screws (298).
- Push the enclosure (400) back on and screw the 4 rear-panel feet (460) into position.
- Connect the mains cable and turn on at the mains switch. The instrument is now in the standby mode
- Select Service Level 2 (see Service Functions).
- When the instrument has been started, check the protocol file for errors:
[INFO : Error Log]

Assembly Instructions for R&S ZVAB-B14

Opening the instrument and installing the board

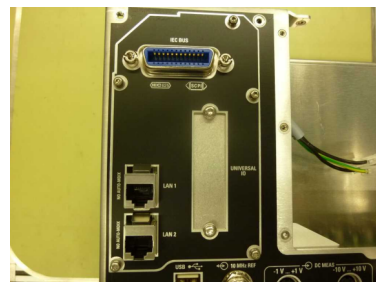
Turn off the instrument and disconnect from the mains, screw off the 4 rear-panel feet (460) and the clamp (405) and pull off the enclosure (400) backwards.



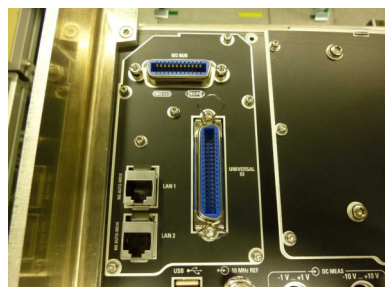
Remove rear panel and replace by enclosed one if necessary (photo: A1.1, A1.2, A1.3)



A1.1 Rear Panel Version 1



A1.2 Rear Panel Version 2

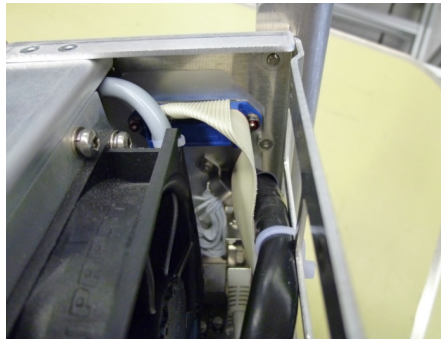


A1.3 Rear Panel new Version

Screw-fasten cable W245 (black) 1305.6335.00 and cable clamp. Cable clamp and shielding need to have contact to rear panel (photo:A1.3, A2, A3)



A2



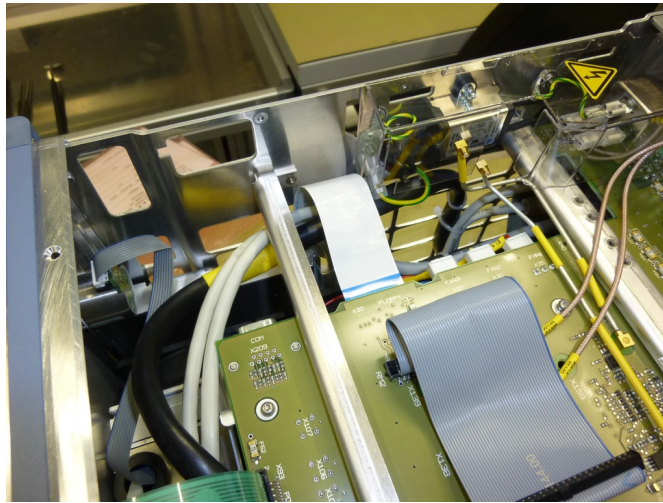
A3

Remount Rear Panel

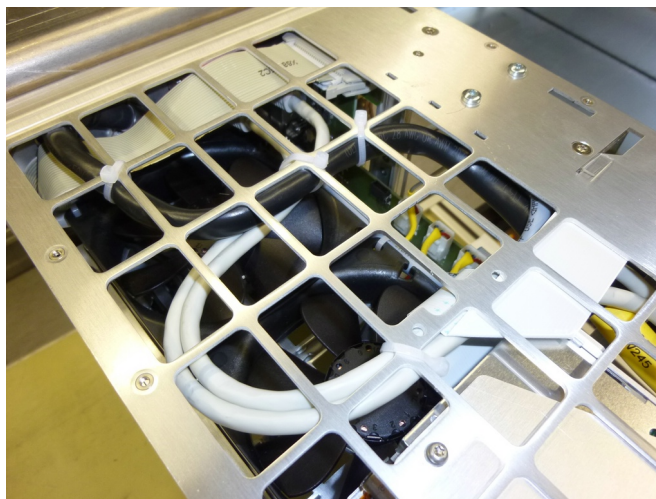
Fasten cable W245 (black) 1305.6335.00 to the fan and fix in place with cable binder
(photo: A4, A5, A6)



A4



A5

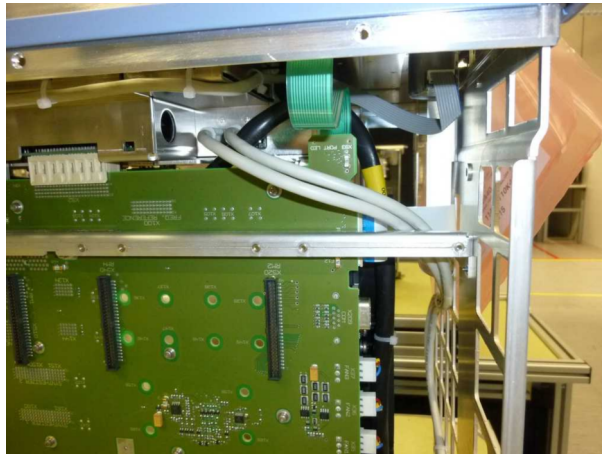


A6

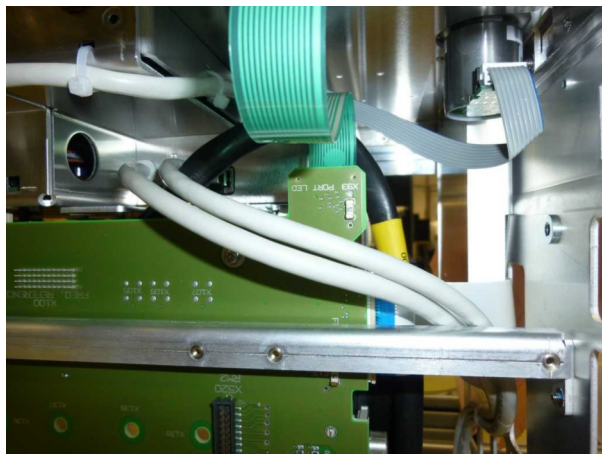
Disassembly of test set

Remove reflectometer port 2 (see chapter Replacing Reflectometer RM..)

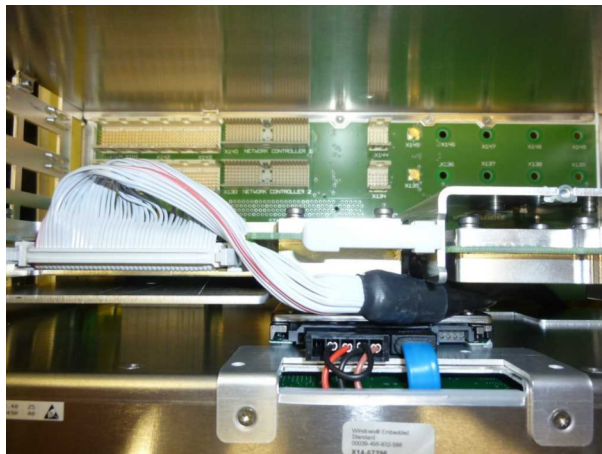
Feed cable W245 (black) 1305.6335.00 through at the opening near motherboard (photo: A7, A8) und push it up. Plug universal interface board into the slot and connect it with cable W245 1305.6335.00 (photo: A9).



A7



A8



A9

Remount reflectometer and enclosure

Activate the Option ZVAB-B14 with the servicetool.

The instrument must be completely calibrated via servicetool. Afterwards it has to be completely measured with the UCS. For the option ZVAB-B14, the ZVAB-testadapter (5007.6929.02) is necessary.

Troubleshooting

The instructions in this manual describe troubleshooting down to the board level. Any defective boards can then be replaced and the instrument put back into operation. A selftest which checks the board diagnostic voltages and displays limit violations is provided to facilitate troubleshooting and diagnosis.

We recommend that you return your instrument to the technical specialists at an R&S service facility for board replacement and any further repairs that may be needed (see the address list at the beginning of this manual).



WARNING

Do not insert or remove boards that are still live

Avoid causing shorts when measuring voltages

The R&S ZVB has the following facilities to simplify diagnosis:

- Selftest
- Service functions

N.B. *The first thing to do if you encounter any problems is to check if any connection (cables, edge connectors etc.) are damaged or even incorrectly inserted.*

Test Equipment and Accessories

Item.	Instrument type	Recommended features	Recommended model	R&S Order No.	Qty.
1	DC meter		R&S URE	0350.5315.02	1
2	Power supply	0 to 10 V			
3	Spectrum analyzer	Frequency range 0 to 20 GHz	R&S FSEB 20	1066.3010.20	1
4	Adapter cable	1 m long SMP male to SMA male	-	1129.8259.00	1
5	Adapter cable	0.5 m long SMP male to SMP male	-	1129.8265.00	1
6	SMA cable	0.5 m long SMA male to SMA male	-	1142.5895.00	2
7	SMA cable	1 m long SMA male to SMA male	-	1142.5889.00	2
8	BNC cable	1 m to 2 m long BNC male to BNC male	-	e.g. 1100.8850.00	1
9	Adapter	SMA female to N male	-	4012.5837.00	2
10	Adapter	N male to BNC female	-	0118.2812.00	1
11	Termination	SMA termination. 50 Ω male	-	0249.7823.00	3
12	SMP adapter	SMP female to SMP female	-	1093.6869.00	1
13	Adapter board	Extension 150 mm high, 48 pins, 2 mm pitch	-	1100.3542.02	1
14	Conn. Cables for DC Inputs	4-pin mini-DIN plug	R&S ZV-Z71	1164.1005.02	1

Troubleshooting - Power-up Problems

- **Fault: It is not possible to turn on the R&S ZVB.**

Action	Cause of fault / remedy
Check mains switch on the rear panel ↓ Check LED is yellow (standby) ↓	Mains switch OFF: Turn on at mains switch. LED does not come on: ➤ Measure voltage at X92.C23 (Front module controller): Nom. value: $+13.5\text{ V} \pm 1\text{ V}$ Nom. value reached: Fault in key pad or controller. No voltage: Power supply defective or short to 12 V standby.
Turn on instrument. Check LED is green ↓	LED does not come on: ➤ Measure the PWR-ON signal at power supply X92.B24: < 1V for ON Voltage > 1V: Key pad or controller defective.

- **Fault: Fan not working.**

Action	Cause of fault / remedy
Check voltage at connector: X35, X36, X37 pin 3: nom. value 12 V ↓	If no voltage can be measured the fan fuse may be defective (F12, F62, F63)
Select Service Function Set Service Level 1 Set Service Function 2.5.0.11.1.5 (max. fan speed) Check voltage at connector: X35, X36, X37 pin 3: nom. value 0.9V	

Troubleshooting Boot Problems

- **Fault: R&S ZVB does not start the measurement application.**

The first action the R&S ZVB performs after power-up is booting BIOS for the processor. When the processor has been successfully initialised, the Windows XP start-up procedure begins. Then, the measurement application is loaded as an autostart program.

If there are errors during the boot phase, messages indicate possible defects.

The message “No System Disk or Disk error...” indicates that the hard disk data is corrupt. If this is the case, replace the hard disk.

If the operating system on the hard disk has been corrupted and so cannot be loaded correctly, Windows XP outputs a “blue screen”.

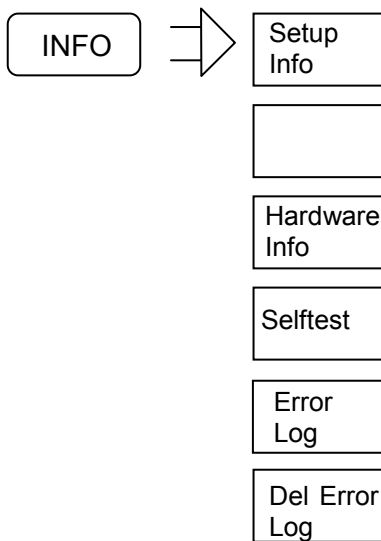
This screen summarizes all the key information about the internal status of the processor.

Troubleshooting - Boot Error

If the message below appears on the screen when the boot procedure has been completed,

Warning: Boot error occurred. For details browse Error Log file.

the cause of the error can be found in the Error-Log file.



Press the *Error Log* softkey.

The results are displayed on the screen.

Cause of error: Data cannot be read from one or more boards.

When the instrument is booted, all the calibration data that is required must be written to the processor's RAM.

When the NWA application is started, the entry on the hard disk is compared with the Eprom data on the board. If the data matches, the data is loaded from the hard disk into RAM. If there is not a match, the Eprom data is written to the hard disk and then loaded into RAM.

If the data at the specified address cannot be read, a check is made in Config.ini to check if the board in question should be present. If so, the board is simulated (i.e. if this board is present and is functioning physically, the instrument will function) and an entry is made in the ErrorLog file.

If a board must always be physically present, (frequency reference, synthesizer1, NetworkController1, reflectometer1, reflectometer2), an error message is output.

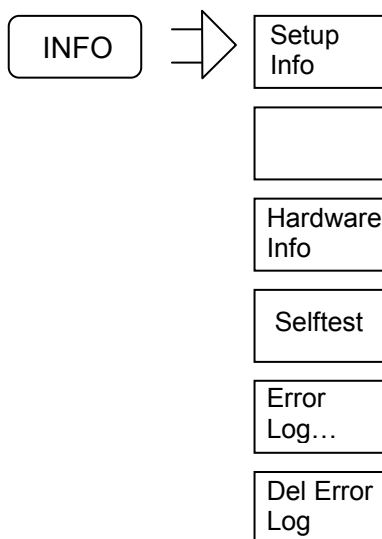
See: Troubleshooting with the Selftest

Troubleshooting with the Selftest

The selftest is used to check supply voltages to the boards, including voltages generated on the boards themselves. On the frequency reference board, two clock signals (128 MHz and ADC-CLK) are also measured.

Starting the selftest:

- Select Service Level 2 (see Service Functions) – this means that the temperature sensor readings are displayed and tighter voltage tolerances used.
- Call the selftest in the INFO menu:



Start the selftest with the *Selftest* softkey.

The selftest results are displayed on the screen.

In the selftest result-table, an abbreviation is used for every board designation:

Fr	Frequency reference
Nd1	Network controller1, digital section
Nd2	Network controller2, digital section (only 4-port instruments)
Sy1/DDSCON	Synthesizer1
Sy1/DDSCON	Synthesizer2(only 3-port and 4-port instruments)
Rm1	Reflectometer port1
Rm2	Reflectometer port2
Rm3	Reflectometer port3 (applies only to 3-port and 4-port-instruments)
Rm4	Reflectometer port4 (applies only to 4-port instruments)

Total selftest status: user mode ---PASSED---



Instrument Type: R&S ZVB8 with 4 Ports

Part Number: 1145.1010k10

Product ID: 01.00

Serial Number: 100124

IP Addresses

IP Address: 0.0.0.0&nbs;

Subnet Mask: 0.0.0.0

IP Address: 0.0.0.0

Subnet Mask: 0.0.0.0

IP Address: 127.0.0.1 (Localhost)

Subnet Mask: 255.0.0.0

SyMapping: R&S ZVB8_P4

LO Divider: is active

Date: 05/28/04

Time: 14:52:57

Voltages Fr

Test description	Min	Max	Result	State
+10V_A SUPPLY	1.550V	1.950V	1.756V	PASSED
+5V_A SUPPLY	1.400V	1.800V	1.560V	PASSED
+5V_REF	1.400V	1.800V	1.560V	PASSED
+12V_STB	1.900V	2.300V	2.112V	PASSED
128_VCXO	0.800V	4.000V	2.696V	PASSED
ADC_CLK	0.800V	4.000V	2.060V	PASSED
-10V_A SUPPLY	1.900V	2.300V	2.128V	PASSED
-5V_A SUPPLY	2.100V	2.500V	2.264V	PASSED

Voltages Nd1

Test description	Min	Max	Result	State
+5VA_ADC	2.250V	2.750V	2.488V	PASSED
+2.5VD_MDD1	1.125V	1.375V	1.264V	PASSED
+2.5VD_MDD2	1.125V	1.375V	1.264V	PASSED
+1.5VD_FCON	0.675V	0.825V	0.752V	PASSED
-5VA_ADC	2.250V	2.750V	2.464V	PASSED
DGND1	0.000V	0.200V	0.000V	PASSED
DGND2	0.000V	0.200V	0.000V	PASSED
AGND	0.000V	0.200V	0.000V	PASSED

Voltages Nd2

Test description	Min	Max	Result	State
+5VA_ADC	2.250V	2.750V	2.484V	PASSED
+2.5VD_MDD1	1.125V	1.375V	1.260V	PASSED

+2.5VD_MDD2	1.125V	1.375V	1.260V	PASSED
+1.5VD_FCON	0.675V	0.825V	0.752V	PASSED
-5VA_ADC	2.250V	2.750V	2.460V	PASSED
DGND1	0.000V	0.200V	0.000V	PASSED
DGND2	0.000V	0.200V	0.000V	PASSED
AGND	0.000V	0.200V	0.000V	PASSED

Voltages Sy1\DDSCON

Test description	Min	Max	Result	State
+10V_A SUPPLY	1.500V	2.000V	1.752V	PASSED
+5V_A SUPPLY	1.300V	1.800V	1.560V	PASSED
+5V_REF	1.300V	1.800V	1.568V	PASSED
+7V_A SUPPLY	1.400V	1.900V	1.628V	PASSED

Voltages Sy2\DDSCON

Test description	Min	Max	Result	State
+10V_A SUPPLY	1.500V	2.000V	1.752V	PASSED
+5V_A SUPPLY	1.300V	1.800V	1.560V	PASSED
+5V_REF	1.300V	1.800V	1.564V	PASSED
+7V_A SUPPLY	1.400V	1.900V	1.616V	PASSED

Voltages Rm1

Test description	Min	Max	Result	State
GND	0.000V	0.200V	0.000V	PASSED
GND	0.000V	0.200V	0.000V	PASSED
+5V SUPPLY	2.300V	2.700V	2.496V	PASSED
+10.5VA SUPPLY	2.300V	2.800V	2.564V	PASSED
+10.5VB SUPPLY	2.300V	2.800V	2.564V	PASSED
+12V FAN	2.000V	2.600V	2.216V	PASSED
+12V SUPPLY	2.000V	2.600V	2.204V	PASSED
-12V SUPPLY	1.600V	2.000V	1.796V	PASSED

Voltages Rm2

Test description	Min	Max	Result	State
GND	0.000V	0.200V	0.000V	PASSED
GND	0.000V	0.200V	0.000V	PASSED
+5V SUPPLY	2.300V	2.700V	2.500V	PASSED
+10.5VA SUPPLY	2.300V	2.800V	2.576V	PASSED
+10.5VB SUPPLY	2.300V	2.800V	2.592V	PASSED
+12V FAN	2.000V	2.600V	2.204V	PASSED
+12V SUPPLY	2.000V	2.600V	2.204V	PASSED
-12V SUPPLY	1.600V	2.000V	1.796V	PASSED

Voltages Rm3

Test description	Min	Max	Result	State
GND	0.000V	0.200V	0.000V	PASSED
GND	0.000V	0.200V	0.000V	PASSED
+5V SUPPLY	2.300V	2.700V	2.500V	PASSED
+10.5VA SUPPLY	2.300V	2.800V	2.584V	PASSED
+10.5VB SUPPLY	2.300V	2.800V	2.600V	PASSED
+12V FAN	2.000V	2.600V	2.196V	PASSED
+12V SUPPLY	2.000V	2.600V	2.220V	PASSED
-12V SUPPLY	1.600V	2.000V	1.800V	PASSED

Voltages Rm4

Test description	Min	Max	Result	State
GND	0.000V	0.200V	0.000V	PASSED
GND	0.000V	0.200V	0.000V	PASSED
+5V SUPPLY	2.300V	2.700V	2.492V	PASSED
+10.5VA SUPPLY	2.300V	2.800V	2.604V	PASSED
+10.5VB SUPPLY	2.300V	2.800V	2.568V	PASSED
+12V FAN	2.000V	2.600V	2.216V	PASSED
+12V SUPPLY	2.000V	2.600V	2.136V	PASSED
-12V SUPPLY	1.600V	2.000V	1.804V	PASSED

[Voltages Fr](#)
[Voltages Nd1](#)
[Voltages Nd2](#)
[Voltages Sy1\DDSCON](#)
[Voltages Sy2\DDSCON](#)
[Voltages Rm1](#)
[Voltages Rm2](#)
[Voltages Rm3](#)
[Voltages Rm4](#)
[Home](#)

Interpreting the Results of the Selftest

Negative voltages are transformed into positive voltages by means of a positive voltage and a resistor network because the A/D converters that are used can handle only positive voltages. This is why an acceptable negative voltage may elicit a FAIL because the associated positive voltage is out of tolerance.

The voltages supplied by the power supply are not checked directly. The failure of a power supply voltage can, however, be deduced from FAILs of certain voltages on several boards. The following Table shows how the board-oriented voltages checked during the selftest are derived from the power supply voltages.

Power supply	+3.4 V	+5.2 V	+6.5 V	+8.25 V	+12.25 V	-6.5 V	-12.25 V
Fr			+5V_A +5 V_REF		+10 V_A +12V_STB	-5 V_A	-10 V_A
Nd	+2.5 VD_MDD1 +2.5 VD_MDD2 +1.5 VD_FCON		+5 VA_ADC			-5 VA_ADC	
Sy			+5 V_A +5 V_REF		+7 V_A +10 V_A		
Rm			+5 V		+10.5 VA +10.5 VB +12 V +12V FAN		-12 V

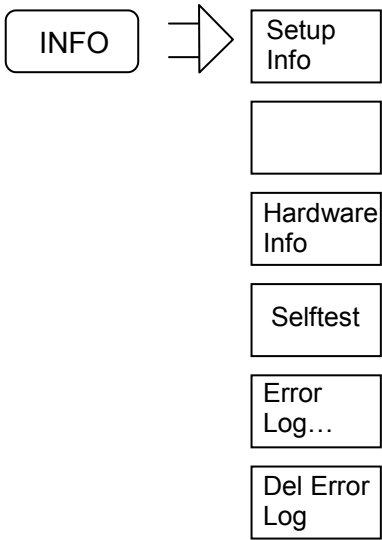
If the voltages listed in a column are all FAIL, the corresponding power supply voltage has failed or is out-of-tolerance. The power supply must then be replaced.

On the motherboard, there is a separate fuse for each board and for each of the power supply voltages used on the board. If a FAIL message is output, the first action to take is to check the fuse. The LO divider board must be removed before the fuses on the motherboard can be checked (See Chapter Board Replacement).

If an internal board voltage is out-of-tolerance, even though the power supply voltages used on the board are OK, the board must be replaced.

Checking the Temperature Sensors

Select Service Level 2 (see Service Functions).



When the *Hardware Info* softkey is pressed information about the installed hardware, the results of temperature measurements and ... are displayed.

Temperature Info

Current Temperature Readings

Component	Sensor	Temperature	Sensor	Temperature	Sensor	Temperature
Motherboard	Near NC:	33.75°C	Near SY:	34.75°C	Near PS:	38.50°C
Netcon 1	Analog:	40.25°C	Digital:	49.75°C		
Netcon 2	Analog:	----	Digital:	----		
Reflectometer 1	Generator:	38.50°C	Receiver:	42.50°C		
Reflectometer 2	Generator:	36.00°C	Receiver:	38.75°C		
Reflectometer 3	Generator:	38.25°C	Receiver:	40.25°C		
Reflectometer 4	Generator:	39.25°C	Receiver:	41.75°C		

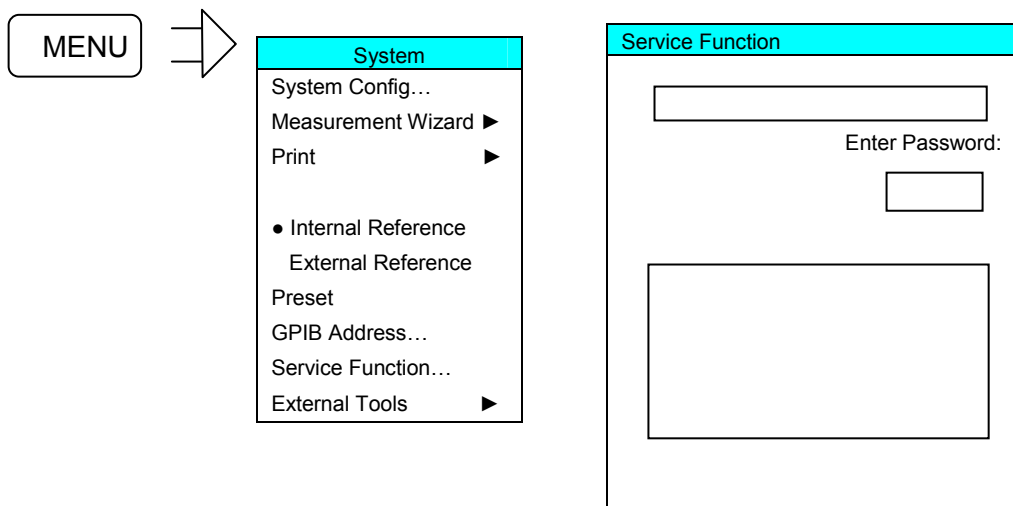
Highly elevated temperature values indicate a fan failure.

Service Functions

The service functions allow you to examine particular circuit sections on specific boards or to make well-defined settings that would normally change automatically according to the state of the instrument (e.g. the IF). There are a number of service functions which, if used incorrectly, could cause the instrument to malfunction. Usually, these functions are disabled. They are enabled only after a code number (PASSWORD) has been entered.

There are three different service levels:

Service level	Password
0	No password necessary
1	894129
2	30473035



Service Function Structure



Group	Applies to
1	API
2	HW (boards)

Boards Main ID	Boards Sub ID
0: All boards	0
1: Network controller1	0: All board 1: PCI 2: ND 3: NA
2: Network controller2	
5: Motherboard	0:
9: Frequency reference	0:
11: Synthesizer1	0: All board 1: SY1 2: SY2 3: SY3 4: SY4
12: Synthesizer2	
21: Reflectometer1	0: all board 1: GEN 2: REC
22: Reflectometer 2	
23: Reflectometer 3	
24: Reflectometer 4	

**Group 1:
General Functions**

Functions	Servicefunction	Data	Serv. Lev.
Enables/disables the peak detector and RMS detector independently of the model	1.0.0.1.X	0 → Use disabled 1 → Use enabled	2
Enable/disables the arbitrary mode settings in the port configuration (e.g. LowNoise/LowDistortion) independently of the model	1.0.0.5.X	0 → Use disabled 1 → Use enabled	2
Activates or deactivates the setting of measured values to default values when status messages are issued due to HW faults	1.1.0.2.X	0 → Deactivate default values 1 → Activate default values	0
Activates or deactivates factory calibration for the active setup	1.1.0.3.X	0 → Deactivate factory calibration 1 → Activate factory calibration	0

**Group 2:
General Functions**

Functions	Service function	Data	Serv. Lev.
Suppress error-message box	2.0.0.0.X	X = 0 → MSG box is output (default state) X = 1 → MSG box is suppressed (error is nevertheless entered in the log file)	1
Selftest all boards	2.0.0.5.0.0		0, 1 or 2

Network controller

Functions	Service function	Data	Serv. lev.
ND1:Read Temp (addr.:68)	2.1.2.3		1
ND2:Read Temp (addr.:68)	2.2.2.3		1
ND[1..2] Selftest	2.[1-2].2.5.0.0		0, 1 or 2
NA1:Read Temp (addr.:69)	2.1.3.3		1
NA2:Read Temp (addr.:69)	2.2.3.3		1

Motherboard

Functions	Service function	Data	Serv. lev.
MB: Fan manual	2.5.0.11.1.X	X = 0 to 5	1
MB: Fan automatic	2.5.0.11.0		1
MB:Read Temp Front (NC) (addr.:205)	2.5.0.3.1		1
MB: Read Temp Rear (SY) (addr.: 204)	2.5.0.3.2		1
MB: Read Temp Back (PS) (addr.: 202)	2.5.0.3.3		1

Frequency reference

Functions	Service function	Data	Serv.lev.
FR Selftest	2.9.0.5.0.0		0, 1 or 2

Reflectometers

Functions	Service function	Data	Serv.lev.
RM[1-4]: Fan manual	2.[21-24].0.11.X	X = 1 to 5	1
RM[1-4]:Fan automatic	2.[21-24].0.11.0		1
RM[1-4]: Read Temp Gen	2.[21-24].1.3		1
RM[1-4]: Read Temp Rec	2.[21-24].2.3		1
RM[1-4]: Selftest	2.[21-24].0.5.X	X = 0 to 4	1
RM[1-4]: Read OVL	2.[21-24].0.12		1
RM[1-4]: OVL Reset	2.[21-24].0.13		1
RM[1-4] Generator Selftest	2.[21-24].1.5.0.0		0, 1 or 2
RM[1-4]: IF shift	2.[21-24].2.18.ZF	IF in Hz 0 = IF via shift table	0

Determining which Boards are defective

The table below lists boards that are probably defective based on the faults that occurred during the performance test.

		Defective board	
Problem with:		Probable	Also possible
Frequency accuracy		Frequency reference	
SSB phase-noise	Only one port All ports	Synthesizer1 Frequency reference	
Level accuracy	Only one port All ports	Reflectometer associated with defective port Synthesizer1	
Max. output level	Only one port All ports	Reflectometer associated with defective port Synthesizer1	
Absolute accuracy wave quantity a		Reflectometer associated with defective port	
Level linearity		Reflectometer associated with defective port	
Harmonic ratio		Reflectometer associated with defective port	Synthesizer1
Spurious suppression		Synthesizer1	
Matching portx		Bridge unit of reflectometer associated with the defective port	
Directivity portx		Bridge unit of reflectometer associated with the defective port	
Receiver absolute accuracy	Port 1, 2 Port 3, 4 All ports	Reflectometer associated with defective port Reflectometer associated with defective port Synthesizer1	Network controller1 Network controller2 Frequency reference
Receiver linearity for high levels	Portx All ports	Reflectometer associated with defective port LO divider	LO divider Synthesizer2
Receiver linearity for low levels	Port1, 2 Port3, 4	Network controller1 Network controller2	
Receiver noise level portx		Reflectometer associated with defective port	Synthesizer2 or synth.1 for 2-port models
Dynamic range portx		Reflectometer associated with defective port (see Circular 10028)	Synthesizer2 or. synth.1 for 2-port models
DC measurement input1V		Motherboard	Network controller1
DC measurement input 10V		Motherboard	Network controller1
Frequency reference input/output		Frequency reference	
Accuracy on S-parameter measurements depending on meas. bandwidth		See Circular 10029	

A board test should be performed before the board that has been deduced to be defective is replaced.

Board Test

When boards are being tested, internal sources are used whenever possible. This means that it is always assumed that the downstream board in the signal path is OK. If a clear fault is not present, the order of the board tests given below should always be followed.

The inputs and outputs of the boards to be tested can be accessed via cables in the lower section of the instrument (except the frequency reference board).

Opening the instrument

(See Chapter 5, drawing 1145.1010)

- Turn off the instrument and disconnect from the mains, screw off the 4 rear-panel feet (460) and pull off the enclosure (400) backwards.
- Remove the instrument base cover (297) after undoing the 12 countersunk screws (299).

Only when testing the frequency reference board:

- Lift off the instrument top cover (296) after undoing the 23 (2 ports) or the 28 (4 ports) countersunk screws (298).

Testing the frequency reference board

(see **Test Equipment**)

- Remove the board from the instrument.
- Reinsert board and extension card.
- Connect the output to be tested to the spectrum analyzer using an adapter cable and adapter SMA-N.
- Set the frequencies listed in the table.
- Check signals according to following table.

Signal	Connector	Frequency	Nom. level	Setting
NA1_AD_CLK	X103	80 MHz	10 dBm $\pm$ 1dB	
NA2_AD_CLK	X104	80 MHz	10 dBm $\pm$ 1dB	
SY1_REF	X105	128 MHz	10 dBm $\pm$ 1dB	
SY2_REF	X106	128 MHz	10 dBm $\pm$ 1dB	
REF_10_OUTIN	X107	10 MHz	6 dBm $\pm$ 1dB	Menu/System/Internal Reference

The board must be replaced if the signal is more than 2 dB below the stated nominal level.

- Connect the frequency reference output of the spectrum analyzer to X107 (REF_10_OUTIN) using an adapter cable and adapter SMA-N.
- Connect X105 or X106 (SY1_REF or. SY2_REF) to the spectrum analyzer using an adapter cable and adapter R&S SMA-N.
- The 128 MHz signal's frequency must precisely equal its nominal frequency.

If the frequency differs in any way (e.g. 128.001 MHz), replace the board.

Testing the Synthesizer Board

N.B.: Synthesizers with part numbers 1145.xxxx or 1300.xxxx are no longer available. In case of defect please contact the Central Service in Munich.

Synthesizer1

- Disconnect source cable at the reflectometer (1 to 4, depending on which synthesizer section is to be tested).
- Connect the end of the source cable to the spectrum analyzer input via an adapter cable and adapter SMA-N.

N.B.: Bend the source cable as little as possible, *if necessary secure adapter cable with adhesive tape.*

- Set the frequencies listed in the table on the R&S ZVB and check the values.
 [**Sweep** : Sweep Type : CW Mode : CW Frequency : ...Hz]
 [**Sweep** : Single : **Restart**]

Synthesizer 1145.xxxx or 1300.xxxx

Frequency (R&S ZVB setting)	Level	2nd harmonic	3rd harmonic	SSB noise carrier offset 100 kHz
300 kHz	0 dBm $\pm$ 3 dB	< -28 dBc	< -28 dBc	-130 dBc
100 MHz	0 dBm $\pm$ 3 dB	< -28 dBc	< -28 dBc	-130 dBc
1 GHz	0 dBm $\pm$ 3 dB	< -28 dBc	< -28 dBc	-126 dBc
2 GHz	0 dBm $\pm$ 3 dB	< -28 dBc	< -28 dBc	-120 dBc
3 GHz	0 dBm $\pm$ 3 dB	< -28 dBc	< -28 dBc	-116 dBc
4 GHz	0 dBm $\pm$ 3 dB	< -28 dBc	< -28 dBc	-112 dBc
6 GHz	0 dBm $\pm$ 3 dB	< -28 dBc	< -28 dBc	-108 dBc
8 GHz	0 dBm $\pm$ 3 dB	< -28 dBc	< -28 dBc	-105 dBc

Synthesizer-LS 1302.4290.xx

Source Mod. 02

Frequency (R&S ZVB setting)	Source Level (Mod. 02)	2nd harmonic	3rd harmonic	SSB noise carrier offset 100 kHz
300 kHz	+3 dBm to -5 dBm	< -27 dBc	< -30 dBc	-130 dBc
100 MHz	+3 dBm to -5 dBm	< -27 dBc	< -30 dBc	-130 dBc
1 GHz	+3 dBm to -5 dBm	< -27 dBc	< -30 dBc	-126 dBc
2 GHz	+3 dBm to -5 dBm	< -27 dBc	< -30 dBc	-120 dBc
3 GHz	+3 dBm to -5 dBm	< -27 dBc	< -30 dBc	-116 dBc
4 GHz	+3 dBm to -5 dBm	< -27 dBc	< -30 dBc	-112 dBc
6 GHz	+3 dBm to -7 dBm	< -27 dBc	< -30 dBc	-108 dBc
8 GHz	+3 dBm to -7 dBm	< -27 dBc	< -30 dBc	-105 dBc

Local Mod. 02, Mod. 03

Frequency (R&S ZVB setting)	Local Level (Mod. 02, Mod. 03)	2nd harmonic	3rd harmonic	SSB noise carrier offset 100 kHz
300 kHz	+3 dBm to -3 dBm	< -28 dBc	< -5 dBc	-130 dBc
100 MHz	+3 dBm to -3 dBm	< -28 dBc	< -5 dBc	-130 dBc
1 GHz	+3 dBm to -3 dBm	< -25 dBc	< -5 dBc	-126 dBc
2 GHz	+3 dBm to -3 dBm	< -25 dBc	< -5 dBc	-120 dBc
3 GHz	+3 dBm to -3 dBm	< -25 dBc	< -5 dBc	-116 dBc
3.8 GHz	-3 dBm to -10 dBm	< -25 dBc	< -14 dBc	-116 dBc
4 GHz	+3 dBm to -3 dBm	< -25 dBc	< -30 dBc	-112 dBc
5.2 GHz	+2 dBm to -4 dBm	< -25 dBc	< -30 dBc	-108 dBc
5.3 GHz	+7 dBm to +2 dBm	< -25 dBc	< -30 dBc	
7.2 GHz	+7 dBm to +2 dBm	< -25 dBc	< -30 dBc	
8 GHz	+7 dBm to 0 dBm	< -25 dBc	< -30 dBc	-105 dBc

Local Mod. 20

Frequency (R&S ZVB setting)	Local Level (Mod. 20)	2nd harmonic	3rd harmonic	SSB noise carrier offset 100 kHz
300 kHz	-3 dBm to -10 dBm	< -28 dBc	< -5 dBc	-130 dBc
100 MHz	-3 dBm to -10 dBm	< -28 dBc	< -5 dBc	-130 dBc
1 GHz	-3 dBm to -10 dBm	< -25 dBc	< -5 dBc	-126 dBc
2 GHz	-3 dBm to -10 dBm	< -25 dBc	< -5 dBc	-120 dBc
3 GHz	-3 dBm to -10 dBm	< -25 dBc	< -5 dBc	-116 dBc
3.8 GHz	-3 dBm to -10 dBm	< -25 dBc	< -14 dBc	-116 dBc
4 GHz	-3 dBm to -10 dBm	< -25 dBc	< -30 dBc	-112 dBc
5.2 GHz	-5 dBm to -10 dBm	< -25 dBc	< -30 dBc	-108 dBc
5.3 GHz	+1 dBm to -4 dBm	< -25 dBc	< -30 dBc	
7.2 GHz	+1 dBm to -4 dBm	< -25 dBc	< -30 dBc	
8 GHz	+7 dBm to 0 dBm	< -25 dBc	< -30 dBc	-105 dBc

Synthesizer-DS 1302.5180.xx

Source 1 to 4 (set port1 to 4 active)

Frequency (R&S ZVB setting)	Source Level	2nd harmonic	3rd harmonic	SSB noise carrier offset 100 kHz
300 kHz	+3 dBm to -5 dBm	< -27 dBc	< -30 dBc	-130 dBc
100 MHz	+3 dBm to -5 dBm	< -27 dBc	< -30 dBc	-130 dBc
1 GHz	+3 dBm to -5 dBm	< -27 dBc	< -30 dBc	-126 dBc
2 GHz	+3 dBm to -5 dBm	< -27 dBc	< -30 dBc	-120 dBc
3 GHz	+3 dBm to -5 dBm	< -27 dBc	< -30 dBc	-116 dBc
4 GHz	+3 dBm to -5 dBm	< -27 dBc	< -30 dBc	-112 dBc
6 GHz	+3 dBm to -7 dBm	< -27 dBc	< -30 dBc	-108 dBc
8 GHz	+3 dBm to -7 dBm	< -27 dBc	< -30 dBc	-105 dBc

Isolation of source switch1 to 4
R&S ZVB frequency 8 GHz

Port no.	Port setting	Source output	Isolation
1	Port1 inactive	X165	-90 dBc ±5 dB
	Port2 active	X166	
2	Port1 active	X165	-90 dBc ±5 dB
	Port2 inactive	X166	
3	Port3 inactive	X168	-90 dBc ±5 dB
	Port4 active	X169	
4	Port3 active	X168	-90 dBc ±5 dB
	Port4 inactive	X169	

The cable loss must also be taken into account at the stated levels. For the specified cable it is 0.25 dB/GHz (0.5 m) 0.5 dB/GHz (1 m).

The board must be replaced if the level is more than 2 dB below the specified value or the other values are more than 2 dB above their specified value.

Synthesizer2 or synthesizer1 for R&S ZVB4/8 2-ports

- Disconnect the LO cable at the LO divider (or at the reflectometer).
- Connect the end of the LO cable to the spectrum analyzer input using an adapter cable and adapter SMA-N.

N.B.: Bend the source cable as little as possible, *if necessary secure adapter cable with adhesive tape.*

- Set the frequencies listed in the table above on the R&S ZVB and check the values.

Testing the Reflectometer RM8

Generator levels

It is assumed that the synthesizer section (synthesizer1) associated with the reflectometer to be tested is OK.

- Loosen cable W514 (GEN -> Bridge unit) at both ends and screw off at the generator output GEN.

Note: When loosening, support the cable with a 7 mm spanner

- Connect the generator output to the spectrum analyzer using the SMA cables () and adapter SMA-N.
- Set the power to 8 dBm
- Set the R&S ZVB to the CW sweep mode.
- Set the frequencies listed in the table.

Frequency	Level	2nd harmonic	3rd harmonic
300 kHz	16 dBm	---	---
50 MHz	16 dBm	< - 21 dBc	< - 21 dBc
1 GHz	16 dBm	< - 21 dBc	< - 21 dBc
3 GHz	16 dBm	< - 21 dBc	< - 21 dBc
6 GHz	16 dBm	< - 21 dBc	---
8 GHz	16 dBm	< - 21 dBc	---

With the stated levels, the cable loss must still be taken into account. For the specified cable it is 0.25 dB/GHz.

Receiver levels

The following is assumed:

- The LO synthesizer section (synthesizer1 mod. 04, synthesizer2) associated with the reflectometer to be tested is OK.
 - The network controller associated with the reflectometer to be tested is OK.
 - One reflectometer in the instrument is functioning.
- Loosen cable W515 (Bridge unit -> MEAS) and cable W518 (Bridge unit → REF) at both ends and screw off at the MEAS and REF receiver inputs.

N.B.: When loosening, support the cable with a 7 mm spanner

Connect the receiver input (MEAS or REF) to a functioning instrument port using an adapter cable and adapter SMA-N.

- Set the R&S ZVB to the CW sweep mode.
- Set the frequencies and output levels for the port used for the measurement as indicated in the table and read off the level for the receiver to be tested (wave quantity ax or bx).

Frequency	Output level	Displayed level ax or bx
300 kHz	-20 dBm	0 dBm
50 MHz	-20 dBm	0 dBm
1 GHz	-20 dBm	0 dBm
3 GHz	-20 dBm	0 dBm
6 GHz	-20 dBm	0 dBm
8 GHz	-20 dBm	0 dBm

With the stated levels, the cable loss must still be taken into account. For the specified cable, it is 0.25 dB/GHz (0.5 m) or 0.5 dB/GHz (1 m).

If the measured values are more than 2 dB below the levels and ratios list in the table, the board must be replaced.

Bridge unit levels

The following is assumed:

- One reflectometer in the instrument is OK.

Method 1:

The generator section of the associated reflectometer is OK (output level at the port meets specifications).

- Loosen cable W515 (Bridge unit -> MEAS) and cable W518 (Bridge unit -> REF) at both ends and disconnect at the bridge unit.

N.B.: When loosening, support the cable with a 7 mm spanner

- Connect the bridge unit output (MEAS = connector W515 or REF = connector W518) to a functioning port using the SMA cable and adapter SMA-N to a functioning port. Terminate the bridge unit output that is not used with an SMA termination.
- Screw a SHORT from the N calibration kit to the port connector.
- Set the frequencies and levels listed in the table for the reflectometer associated with the bridge unit (port) and measure the level (wave quantity bx) at the port used for the measurement.

Frequency	Level	Output level MEAS	Output level REF
300 kHz	0 dBm	-18 dBm	-32 dBm
50 MHz	0 dBm	-18 dBm	-32 dBm
1 GHz	0 dBm	-18 dBm	-32 dBm
3 GHz	0 dBm	-18 dBm	-32 dBm
6 GHz	0 dBm	-18 dBm	-32 dBm
8 GHz	0 dBm	-18 dBm	-32 dBm

With the stated levels, the cable loss must still be taken into account. For the specified cable it is 0.25 dB/GHz.

If the measured values are more than 2 dB below the levels in the table, the board must be replaced.

Method 2:

The receive section of the associated reflectometer is OK.

- Loosen cable W514 (GEN -> Bridge unit) at both ends and screw off at the bridge unit.

N.B.: When loosening, support the cable with a 7 mm spanner

- Connect the bridge input (connector. W514) to a functioning port using the R&S SMA cable and R&S SMA-N adapter.
- Screw a SHORT from the N calibration kit to the port connector.
- Set the frequencies and levels listed in the table at the port used for the measurement and measure the level (wave quantity ax or bx) at the reflectometer associated with the bridge unit (port).

Frequency	Level	Output level MEAS	Output level REF
300 kHz	8 dBm	-18 dBm	-32 dBm
50 MHz	8 dBm	-18 dBm	-32 dBm
1 GHz	8 dBm	-18 dBm	-32 dBm
3 GHz	8 dBm	-18 dBm	-32 dBm
6 GHz	8 dBm	-18 dBm	-32 dBm
8 GHz	8 dBm	-18 dBm	-32 dBm

With the stated levels, the cable loss must still be taken into account. For the specified cable it is 0.25 dB/GHz.

If the measured values are more than 2 dB below the levels given in the table, the board must be replaced.

Bridge Directivity

The following is assumed:

- The generator and receiver sections of the reflectometer associated with the bridge unit are OK.
- Screw the SHORT from an N calibration kit to the port connector.
- Perform a sweep from 300 kHz to 8 GHz, measure S11, save measured values (Data -> Mem : Math = Data/Mem).
- Screw the MATCH from the N calibration kit to the port connector.
- The trace gives the directivity.

Frequency range	Directivity
300 kHz to 50 MHz	< -10 dB
50 MHz to 8 GHz	< -16 dB

If the measured values are greater than the values stated in the table, the bridge unit must be replaced.

Bridge unit: Port Matching

It is assumed that there is a functioning reflectometer in the instrument.

- Loosen cables W514 (GEN -> Bridge unit), W515 (Bridge unit -> MEAS) and W518 (Bridge unit -> REF) at both ends and unscrew at the bridge unit.

N.B.: When loosening, support the cable with a 7mm spanner

- Terminate the bridge unit input and bridge unit outputs with 3 SMA terminations.
- Connect N test cable to a functioning instrument port and perform a 1-port calibration at the end of the cable.
- Connect the end of the test cable to the port of the bridge unit under test and display the Sxx magnitude on the screen.

Frequency range	Sxx dB
300 kHz to 2 GHz	-12 dB
2 GHz to 8 GHz	-18 dB

If the values in the table are exceeded, the board must be replaced.

Testing the Reflectometer RM20

Generator levels

It is assumed that the synthesizer section (synthesizer1) associated with the reflectometer to be tested is OK.

- Loosen cable W514 (GEN -> coupler unit) at both ends and screw off at the generator output GEN.
- Connect the generator output to the spectrum analyzer using the R&S SMA cable ().
- Set the R&S ZVB to the CW sweep mode.
- Set the frequencies listed in the table.
- Set the power listed in the table.

Frequency	Set power to	Level on GEN output	2nd harmonic	3rd harmonic
10 MHz	10 dBm	13.0 dBm	---	---
100 MHz	10 dBm	13.0 dBm	< - 21 dBc	< - 21 dBc
1 GHz	10 dBm	13.2 dBm	< - 21 dBc	< - 21 dBc
4 GHz	10 dBm	13.7 dBm	< - 21 dBc	< - 21 dBc
8 GHz	10 dBm	14.3 dBm	< - 21 dBc	< - 21 dBc
9 GHz	10 dBm	14.5 dBm	< - 21 dBc	---
12 GHz	10 dBm	15.0 dBm	---	---
15 GHz	5 dBm	7.5 dBm	---	---
18 GHz	5 dBm	8.0 dBm	---	---
20 GHz	5 dBm	8.3 dBm	---	---

With the stated levels, the cable loss must still be taken into account. For the specified cable it is 0.25 dB/GHz.

Receiver levels

The following is assumed:

- The LO synthesizer section (synthesizer1 mod. 20, synthesizer2) associated with the reflectometer to be tested is OK.
 - The network controller associated with the reflectometer to be tested is OK.
 - One reflectometer in the instrument is functioning.
- Loosen cable W515 (coupler unit -> MEAS) and cable W518 (coupler unit -> REF) at both ends and screw off at the MEAS and REF receiver inputs.
 - Connect the receiver input (MEAS or REF) to a functioning instrument port using an adapter cable.
 - Set the R&S ZVB to the CW sweep mode.
 - Set the frequencies and output levels for the port used for the measurement as indicated in the table and read off the level for the receiver to be tested (wave quantity ax or bx).

Frequency	Output level	Displayed level ax or bx
10 MHz	-30 dBm	+20 dBm $\pm$ 3 dB
100 MHz	-30 dBm	+5 dBm $\pm$ 3 dB
1 GHz	-20 dBm	-5 dBm $\pm$ 3 dB
2.5 GHz	-20 dBm	-10 dBm $\pm$ 3 dB
3 GHz	-20 dBm	-10 dBm $\pm$ 3 dB
8 GHz	-20 dBm	-10 dBm $\pm$ 3 dB
9 GHz	-20 dBm	-10 dBm $\pm$ 3 dB
12 GHz	-20 dBm	-10 dBm $\pm$ 3 dB
15 GHz	-20 dBm	-8 dBm $\pm$ 4 dB
18 GHz	-20 dBm	-8 dBm $\pm$ 4 dB
20 GHz	-20 dBm	-8 dBm $\pm$ 4 dB

With the stated levels, the cable loss must still be taken into account. For the specified cable, it is 0.25 dB/GHz (0.5 m) or. 0.5 dB/GHz (1 m).

If the measured values are more than 2 dB below the levels list in the table, the board must be replaced.

Coupler unit levels

The following is assumed:

- One reflectometer in the instrument is OK.

Method 1:

The generator section of the associated reflectometer is OK (output level at the port meets specifications).

- Loosen cable W515 (coupler unit -> MEAS) and cable W518 (coupler unit -> REF) at both ends and disconnect at the bridge unit.
- Connect the coupler unit output (MEAS = connector W515 or REF = connector W518) to a functioning port using the SMA cable and adapter SMA-N to a functioning port. Terminate the coupler unit output that is not used with an SMA termination.
- Screw a SHORT from the calibration kit to the port connector.
- Set the frequencies and levels listed in the table for the reflectometer associated with the coupler unit (port) and measure the level (wave quantity bx) at the port used for the measurement.

Frequency	Level	Output level MEAS	Output level REF
10 MHz	0 dBm	-50 dBm $\pm$ 3 dB	-47 dBm $\pm$ 3 dB
100 MHz	0 dBm	-35 dBm $\pm$ 3 dB	-32 dBm $\pm$ 3 dB
1 GHz	0 dBm	-15 dBm $\pm$ 3 dB	-11 dBm $\pm$ 3 dB
2 GHz	0 dBm	-10 dBm $\pm$ 3 dB	-4.7 dBm $\pm$ 3 dB
8 GHz	0 dBm	-10 dBm $\pm$ 3 dB	-3.7 dBm $\pm$ 3 dB
12 GHz	0 dBm	-10 dBm $\pm$ 3 dB	-3 dBm $\pm$ 3 dB
16 GHz	0 dBm	-12 dBm $\pm$ 4 dB	-2.3 dBm $\pm$ 4 dB
20 GHz	0 dBm	-12 dBm $\pm$ 4 dB	-1.7 dBm $\pm$ 4 dB

With the stated levels, the cable loss must still be taken into account. For the specified cable it is 0.25 dB/GHz.

If the measured values are more than 2 dB below the levels in the table, the coupler unit must be replaced.

Method 2:

The receiver section of the associated reflectometer is OK.

- Loosen cable W514 (GEN -> coupler unit) at both ends and screw off at the coupler unit.
- Connect the coupler input (connector. W514) to a functioning port using the SMA cable.
- Screw a SHORT from the calibration kit to the port connector.
- Set the frequencies and levels listed in the table at the port used for the measurement and measure the level (wave quantity ax or bx) at the reflectometer associated with the coupler unit (port).

Frequency	Level	Output level MEAS	Output level REF
10 MHz	0 dBm	-53 dBm $\pm$ 3 dB	-50 dBm $\pm$ 3 dB
100 MHz	0 dBm	-38 dBm $\pm$ 3 dB	-35 dBm $\pm$ 3 dB
1 GHz	0 dBm	-18.2 dBm $\pm$ 3 dB	-15 dBm $\pm$ 3 dB
2 GHz	0 dBm	-13.3 dBm $\pm$ 3 dB	-8 dBm $\pm$ 3 dB
8 GHz	0 dBm	-14.3 dBm $\pm$ 3 dB	-8 dBm $\pm$ 3 dB
12 GHz	0 dBm	-15 dBm $\pm$ 3 dB	-3 dBm $\pm$ 3 dB
16 GHz	0 dBm	-17.7 dBm $\pm$ 4 dB	-8 dBm $\pm$ 4 dB
20 GHz	0 dBm	-18.3 dBm $\pm$ 4 dB	-8 dBm $\pm$ 4 dB

With the stated levels, the cable loss must still be taken into account. For the specified cable it is 0.25 dB/GHz.

If the measured values are more than 2 dB below the levels given in the table, the coupler unit must be replaced.

Coupler Directivity

The following is assumed:

- The generator and receiver sections of the reflectometer associated with the coupler unit are OK.
- Screw the SHORT from the calibration kit to the port connector.
- Perform a sweep from 10 MHz to 20 GHz, measure S11, save measured values (Data -> Mem : Math = Data/Mem).
- Screw the MATCH from the calibration kit to the port connector.
- The trace gives the directivity.

Frequency range	Directivity
10 MHz to 12 GHz	< -15 dB
12 GHz to 20 GHz	< -10 dB

If the measured values are greater than the values stated in the table, the coupler unit must be replaced.

Coupler unit: Port Matching

It is assumed that there is a functioning reflectometer in the instrument.

- Loosen cables W514 (GEN -> coupler unit), W515 (coupler unit -> MEAS) and W518 (coupler unit -> REF) at both ends and unscrew at the coupler unit.
- Terminate the coupler unit input and coupler unit outputs with 3 SMA terminations.
- Connect test cable to a functioning instrument port and perform a 1-port calibration at the end of the cable.
- Connect the end of the test cable to the port of the coupler unit under test and display the Sxx magnitude on the screen.

Frequency range	Sxx dB
10 MHz to 12 GHz	< -14 dB
12 GHz to 20 GHz	< -10 dB

If the values in the table are exceeded, the coupler must be replaced.

Testing the LO Divider Board

It is assumed that the LO-synthesizer section (synthesizer2 for 3-port and 4-port-models, synthesizer 1 for 2-port-models) is OK.

- Disconnect cable W656, WW659, W666 or W669, depending on which LO-branch is being tested.
- Connect the output under test (X6, X7, X8 or X9) to the spectrum analyzer using the adapter cable.
- Enter service- function 2.21.2.18.17512345 (IF = 17.512345 MHz).
- Set the R&S ZVB to the CW sweep mode.
- Set the frequencies listed in the table.

Frequency R&S ZVB	Frequency spec. = Frq R&S ZVB + IF	Level
300 kHz (R&S ZVB4/8 only)	17.812345 MHz	5 dBm to 14 dBm
10 MHz	27.512345 MHz	5 dBm to 14 dBm
50 MHz	67.512345 MHz	5 dBm to 14 dBm
1 GHz	1.017512345 GHz	5 dBm to 14 dBm
3 GHz	3.017512345 GHz	5 dBm to 14 dBm
6 GHz	6.017512345 GHz	5 dBm to 19 dBm
8 GHz	8.017512345 GHz	5 dBm to 19 dBm

With the stated levels, the cable loss must still be taken into account. For the specified cable, it is 0.25 dB/GHz (0.5 m) or 0.5 dB/GHz (1 m).

If the measured values are below the levels in the table, the board must be replaced.

Testing the Network Controller Board

Testing the IF inputs

It is assumed that there is one functioning reflectometer in the instrument.

- Disconnect the IF-MEAS and IF-REF cable from each of the reflectometers.
- Connect the input to be tested at the end of the appropriate IF cable (W136, W137, W138, W139, and W146, W147, W148, W149) to a functioning port using the adapter cable and SMA-N adapter .
- Set the R&S ZVB to CW sweep mode, CENTER 17.512345 MHz.
- Setting at the port used for the measurement: POWER -10 dBm
- Setting at the port associated with the network controller under test: WAVE QUANTITY ax or bx.
- Enter service function 2.21.2.18.17512345 (IF = 17.512345 MHz).
- Disable level corrections with SF 2.21[..<24].2.15.1

If the level displayed on the R&S ZVB's screen is not within the range $-4 \text{ dBm} \pm 2 \text{ dB}$, the board must be replaced.

Testing the Motherboard

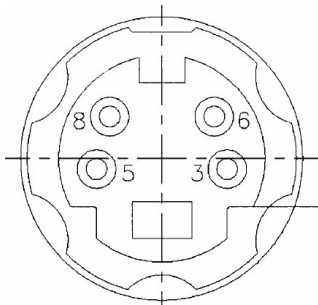
28 V supply

Using a multimeter, measure the voltage at X 100.B5 (wrt ground).
Permissible deviation: ± 0.5 V

Preamplifier for DC measurement inputs

Apply the DC voltages listed in the table using the 4-pin Mini-DIN connector at the DC measurement input.
Measure the DC voltage with a multimeter.

Input	Voltage at	Gnd	APPLIED VOLTAGE	Measurement at	Rated value
DC MEAS -1 V to +1 V	8	3, 5, 6	- 1 V	X 141.B10	2.33 V
DC MEAS -1 V to +1 V	6	3, 5, 8	+ 1 V	X 141.B11	2.33 V
DC MEAS -10 V to +10 V	8	3, 5, 6	- 10 V	X 141.D10	2.33 V
DC MEAS -10 V to +10 V	6	3, 5, 8	+ 10 V	X 141.D11	2.33 V



Pin assignment DC MEAS connector

If the measured value is more than 10% above or more than 10% below the stated nominal value, the motherboard must be replaced.

Table of Contents- Chapter 4 "Software Update / Installation of Options"

4 Software Update / Installation of Options 4.1

 Installing new ZVB Software4.1

 Installing Options4.2

This page has been left blank intentionally.

4 Software Update / Installation of Options

Chapter 4 provides information on updating software, restoring the operating system installation and installing options. Descriptions accompanying the software update or the options can be included in this folder as part of Chapter 4.

Installing new ZVB Software

The instrument firmware can be downloaded from the R&S website (www.rohde-schwarz.com). This is a Microsoft Installation file (.MSI). The file name is ZVAB_XX_YY.MSI for a released version and ZVAB_XX_YY_BETAZZ.MSI for a test version. This file must be made available to the instrument via a suitable medium (Memory Stick, USB CD-ROM drive network or Remote Desktop). The instrument firmware is installed when you double click on the file. The instrument is ready for operation after you switch off and then switch back on again.

Installing Options

The following options can be fitted to the ZVB:

Oven Controlled Crystal Oscillator (OCXO)	R&S ZVAB-B4	1164.1757.02
Universal Interface Board	R&S ZVAB-B14	1305.6306.02
Removable Flash Disc	R&S ZVAB-B18	1164.0715.03
Time Domain	R&S ZVAB-K2	1164.1657.02
Mixer and Harmonic Measurement	R&S ZVAB-K3	1164.1592.02
Direct Generator/Receiver Access		
for R&S ZVB14 1145.1010.17 only (2-port)	R&S ZVB14-B16	1164.1240.17
for R&S ZVB14 1145.1010.19 only (4-port)	R&S ZVB14-B16	1164.1240.19
for R&S ZVB20 1145.1010.23 only (2-port)	R&S ZVB20-B16	1164.1240.23
for R&S ZVB20 1145.1010.25 only (4-port)	R&S ZVB20-B16	1164.1240.25
Generator Step Attenuator for R&S ZVB4 and R&S ZVB8 only		
for Port 1	R&S ZVB8-B21	1302.5480.02
for Port 2	R&S ZVB8-B22	1302.5073.02
for Port 3	R&S ZVB8-B23	1302.5496.02

Install according to the instructions that are supplied with the option.

These installation instructions can be appended to this chapter.

The OCXO option is permanently integrated on the frequency reference board (mod. 03, mod. 05) and, as a rule, it is specified when the instrument is ordered. When it is retrofitted, the frequency reference board must be replaced (replace mod. 02 or mod. 04 with mod. 05).

Installing hardware options:

NOTICE

Before installing the options, disconnect the mains cable.
Observe the safety instructions at the beginning of this manual.
The boards in the instrument are electrostatically sensitive devices (ESD). The appropriate handling instructions for these devices must be observed (ESD workstation).

- Turn off the instrument and disconnect the mains cable.
- Unscrew the 4 back-panel feet (460) and pull off the enclosure (400) towards the rear.
- Follow the **replacement instructions in Chapter 3 or in Chapter 5** (Mechanical Drawings)
- When installation has been completed, push the enclosure back into position and refit the back-panel feet.

NOTICE

When replacing the enclosure, ensure that no cables are damaged or pulled out.

- Connect the mains cable and turn on the instrument.

Contents - Chapter 5 "Documents"

5 Documents..... 5.1

Spare Parts.....5.1

 Available Power Cables.....5.1

Spare Parts List5.3

Mechanical Drawings.....5.3

Block Circuit Diagram5.18

5 Documents

This chapter provides information on the ordering of spare parts and contains the spare parts list and the documents for the complete ZVB unit.

Spare Parts

The stock numbers necessary for ordering replacement parts and modules can be found in the component lists further down.



Important!

When replacing a module, please observe the safety instructions and repair instructions provided in chapter 3 and at the beginning of this service manual

When shipping a module, be sure to provide sufficient mechanical and antistatic protection.

Available Power Cables

Table 5-1 List of power cables available

Stock No.	Earthed-contact connector	Preferably used in
DS 0006.7013.00	BS1363: 1967' 10 A, 250 V complying with IEC 83: 1975 standard B2	Great Britain
DS 0006.7020.00	Type 12, 10 A, 250 V complying with SEV-regulation 1011.1059, standard sheet S 24 507	Switzerland
DS 0006.7036.00	Type 498/13, 10 A, 250 V complying with US-regulation UL 498, or with IEC 83	USA/Canada
DS 0041.4752.00	GB2099, GB1002, 10 A, 250 V approvals CCC	China
DS 0041.6232.00	JIS C 8303, 7A, 125 V AC approvals PSE (JET)	Japan
DS 0006.7107.00	Type SAA3, 10 A, 250 V, complying with AS C112-1964 Ap.	Australia
DS 0025.2365.00 DS 0099.1456.00	DIN 49 441, 10 A, 250 V, angular DIN 49 441, 10 A, 250 V, straight approvals VDE, ÖVE, CEBEC, KEMA, S, D, N, FI, LCIE, IMQ, UCIEE	Europe (except Switzerland)



Spare Parts List

Mechanical Drawings

List of R&S ZVB parts including spare parts

The R&S ZVB is constructed in accordance with R&S Design 2000.

Rackmount: 5E 1/1 T350 MOD. 04/05/06/08/09/10/20/21

Overall dimensions: B x H x T: 465.1 x 241.8 x 417.0

Accessories: 19" Adapter ZZA-511, Stock No. 1096.3290.00

Rackmount: 6E 1/1 T350 MOD. 22

Overall dimensions: B x H x T: 465.1 x 286.2 x 417.0

Accessories: 19" Adapter ZZA-611, Stock No. 1096.3302.00

Note: The recommended spare parts are marked with an x in the last column.

Table 5-2 List of all R&S ZVB parts and spare parts

Position.	Designation	Stock No.	Number	Electrical Designation	Recommended spare parts
DRAWING 1145.1010.01 (ZVB BASE UNIT) & 1145.1332.00 (METAL FRAME)					
10	ZM FUNDAMENTAL UNIT ZVB Mod. 04 05 08 09	1145.1290.08	1		
11	ZM FUNDAMENTAL UNIT ZVB Mod. 06 10	1145.1290.09	1		
12	ZM FUNDAMENTAL UNIT ZVB Mod. 14 20 21	1145.1290.20	1		
13	ZM FUNDAMENTAL UNIT ZVB Mod. 22	1145.1290.22	1		
14	ZM FUNDAMENTAL UNIT ZVB Mod. 17 19 23 25	1145.1290.23	1		
15	ZM FAN ZVB	1145.2200.00	3	E1 E2 E3	x
16	VS 7985/ISR-M4X8-A4-PA	1148.2652.00	12		
17	VS 7985/ISR-M4X6-A4-PA	1148.2646.00	5		
18	VS DIN433-4.3-A4	0082.4586.00	17		
19	VS 965/ISR-M2.5X6-A4-PA	1148.3288.00	4		
100	ZE NETWORK CONTROLLER	1145.3635.02	1	A140	x
105	ZE NETWORK CONTROLLER	1145.3635.02	1	A130	x
110	EE SYNTHESIZER-LS	1302.4025.02	1	A160	x
111	EE SYNTHESIZER-DS	1302.5180.02	1	A160	x
112	EE SYNTHESIZER-LS	1302.4025.20	1	A150	x

Position.	Designation	Stock No.	Number	Electrical Designation	Recommended spare parts
115	EE SYNTHESIZER-LO	1302.4248.02	1	A150	x
116	EE SYNTHESIZER-LO	1302.4248.20	1	A150	x
120	EE FREQ. REFERENCE	1145.3835.04	1	A100	x
121	EE PCI BALANCE	1300.1687.02	1	A100	x
124	ED LO DIVIDER	1300.2002.20	1	A600	x
125	ED LO DIVIDER	1300.2002.02	1	A600	x
126	MZ PLATE LO-DIV ZVB	1300.2025.00	1		
127	VS 6900/ISR-M2.5X6-A2	1148.3059.00	6		
128	VS HVC/ISR-M2.5X16-A2	0048.8218.00	2		
130	MZ LOCKING PLATE	1302.4483.00	2		
136	MZ MOTHERB. RAIL 1 ZVB20	1145.4631.00	1		
137	MZ MOTHERB. RAIL 2 ZVB20	1145.4684.00	1		
138	MZ MOTHERB. RAIL 4 ZVB20 4PORT	1145.4690.00	1		
140	MZ MOTHERB. RAIL 1 ZVB	1145.1926.00	1		
141	MZ MOTHERB. RAIL ZVB	1145.1932.00	1		
142	MZ MOTHERB. RAIL 4 ZVB	1145.2274.00	1		
143	VS 6900/ISR-M2.5X8-A2	0041.1653.00	2		
144	VS 965/ISR-M2.5X6-A4-PA	1148.3288.00	6		
145	MZ MB RAIL CONTACT ZVB8	1300.0851.00	1		
146	MZ MB RAIL CONTACT ZVB8/20	1300.0874.00	1		
147	VS 6900/ISR-M2.5X8-A2	0041.1653.00	1		
148	VS 965/ISR-M2.5X6-A4-PA	1148.3288.00	4		
149	VS 965/ISR-M2.5X6-A4-PA	1148.3288.00	3		
150	VS 965/ISR-M2.5X6-A4-PA	1148.3288.00	2		
151	VS 6900/ISR-M2.5X6-A2	1148.3059.00	4		
155	ZM RM UNIT ZVB 4/8 GHz Mod. 05	1302.3664.04	0	A510 A520 A540	x
156	VS 6900/ISR-M2.5X6-A2	1148.3059.00	6		
158	ZM CABLE SET ZVB	1145.2545.19	1		
161	VS 6900/ISR-M2.5X6-A2	1148.3059.00	8		

R&S ZVB**List of ZVB parts including spare parts**

Position.	Designation	Stock No.	Number	Electrical Designation	Recommended spare parts
164	ZM CABLE SET ZVB	1145.2545.11	1		
165	ZM RM UNIT ZVB 4/8 GHz	1302.4960.08	2	A510 A520	x
166	ZM CABLE SET ZVB	1302.5044.08	1		
170	ZM RM UNIT ZVB 4/8 GHz Mod. 05 09	1302.4960.08	3	A510 A520 A540	x
175	ZM RM UNIT ZVB 4/8 GHz Mod. 06 10	1302.4960.08	4	A510 A520 A530 A540	x
176	VS 965/ISR-M2.5X8-A4-PA	1148.3294.00	4		
177	VS 965/ISR-M2.5X8-A4-PA	1148.3294.00	6		
178	VS 965/ISR-M2.5X8-A4-PA	1148.3294.00	8		
180	ZM RM UNIT ZVB 20 GHz	1145.4290.20	2		x
181	VS 965/ISR-M3X16-A4-PA	1300.0868.00	8		
182	VS 965/ISR-M2.5X6-A4-PA	1148.3288.00	4		
183	ZM CABLE SET ZVB	1302.5044.20	1		
185	ZM RM UNIT ZVB 20 GHz	1145.4290.20	3		x
186	VS 965/ISR-M3X16-A4-PA	1300.0868.00	12		
188	ZM CABLE SET ZVB	1145.2545.23	1		
189	OS LABEL FOR REARPANEL	1145.4725.00	1		
190	ZM 2RM UNIT ZVB 20 GHz	1302.4425.02	2		x
192	MZ HOLDING PLATE	1302.4648.00	2		
194	VS 965/ISR-M2.5X6-A4-PA	1148.3288.00	4		
200	ZM CABLE SET ZVB 4PORT	1302.5044.22	1		
210	VS 965/ISR-M2.5X6-A4-PA	1148.3288.00	8		
215	VS 965/ISR-M2.5X6-A4-PA	1148.3288.00	12		
220	VS 965/ISR-M3X16-A4-PA	1300.0868.00	16		
222	VS 965/ISR-M2.5X6-A4-PA	1148.3288.00	8		
230	MZ COVER PLATE ZVB20	1302.4690.00	1		
232	VS 6900/ISR-M2.5X6-A2	1148.3059.00	10		
240	RM UNIT ZVB14/20 2PORT	1305.4790.23	2	A510, A520	
242	CABLE LOOM ZVB14/20 2PORT	1302.5044.23	1		

Position.	Designation	Stock No.	Number	Electrical Designation	Recommended spare parts
244	REFLECTOMETER RAIL ZVB20 4PORT	1305.4710.00	1		
246	REFLECTOMETER RAIL2 ZVB20 4PORT	1305.4703.00	1		
248	VS 965/ISR-M2.5X6-A4-PA	1148.3288.00	8		
250	RM UNIT ZVB14/20 4PORT	1305.4790.25	2	A530, A540	
252	CABLE LOOM ZVB14/20 4PORT	1302.5044.25	1		
260	MZ REAR PLATE	1145.1903.00	1		
265	VS 6900/ISR-M2.5X6-A2	1148.3059.00	5		
270	2XRJ45 COUPLER JACK STRAIGHT	1093.9122.00	2	X241 X242	x
272	SILICON CORD 4x8 MM	1130.0164.00	2		
275	DG PATCHCABLE	0041.9283.00	2	W241 W242	
280	DY IEC/IEEE BUS CABLE W21	1129.7252.00	1	W21	
282	VS DIN125-A3.2-A4	0082.4670.00	2		
284	VS DIN137-A3-A2	0005.0296.00	2		
286	VS DIN934-M3-A4	0016.4398.00	2		
290	MP COVER 25-PIN SUB-D	1093.9000.00	1		
291	MP COVER FOR IEC/IEEE BUS	0852.0450.00	1		
294	MP CAP RD11.1/9.9	0009.9217.00	1		
295	ADHESIVE FOIL 33x68	0009.9217.00	1		
296	MZ COVER ZVB	1145.1849.00	1		
297	MZ COVER BOTTOM ZVB	1145.1961.00	1		
298	VS 965/ISR-M2.5X6-A4-PA	1148.3288.00	33		
299	VS 965/ISR-M2.5X6-A4-PA	1148.3288.00	12		
300	KB FRONT COVER ZVB4 2-PORT	1145.1403.00	1		
303	KB FRONT COVER ZVB 4	1145.1426.00	1		
306	KB FRONT COVER ZVB4 4-PORT	1145.1410.00	1		
310	KB FRONT COVER ZVB8 2-PORT	1145.1455.00	1		
313	KB FRONT COVER ZVB 8	1145.1432.00	1		
316	KB FRONT COVER ZVB8 4-PORT	1145.1461.00	1		
317	KB FRONT COVER ZVB14 2-PORT	1305.4903.00	1		

R&S ZVB**List of ZVB parts including spare parts**

Position.	Designation	Stock No.	Number	Electrical Designation	Recommended spare parts
318	KB FRONT COVER ZVB14 4-PORT	1305.5180.00	1		
320	KB FRONT COVER ZVB20 2-PORT	1145.1490.00	1		
323	KB FRONT COVER ZVB20 3-PORT	1145.1449.00	1		
324	KB FRONT COVER ZVB20 4-PORT	1302.4525.00	1		
327	KB FRONT COVER ZVB14 4-PORT	1305.4890.00	1		
328	KB FRONT COVER ZVB20 2-PORT	1305.4832.00	1		
330	KB FRONT COVER ZVB20 4-PORT	1305.4655.00	1		
390	KB COUNTERSUNK SCREW M1.6X3 LIGHT-GREY	0396.1070.00	1		
400	KR BW2 CASING 5E1/1T350N-ZVB	1145.1826.00	1		
401	KR BW2 CASING 6E1/1T350N-ZVB	1302.4683.00	1		
405	KR HOLDING HOOK	1096.4796.00	1		
406	KR HOLDING HOOK	1096.4796.00	3		
410	KR BW2 FRONT HANDLE 5E	1096.1497.00	2		
411	KR BW2 FRONT HANDLE 6E	1096.1500.00	2		
420	VS SCREW M4X14-ISR	1096.4896.00	4		
425	VS SCREW M4X14-ISR	1096.4896.00	2		
430	KR BW2 INSTRUMENT FOOT	1096.2506.00	4		x
440	KR BW2 MOUNTING FOOT	1096.2529.00	2		x
450	KR BW2 SIDE CARRYING HANDLE T350	1096.2664.00	1		x
452	KR BW2 SIDE COVER	1096.2558.00	2		x
460	KR BW2 REAR PANEL FOOT 50MM	1096.2493.00	4		x
470	OS BW2 LABEL REAR PANEL FOOT	1096.2435.00	1		x
471	FJ CAP FOR N CONECTOR	1096.2435.00	2		
472	FJ CAP FOR N CONECTOR	1096.2435.00	3		
473	FJ CAP FOR N CONECTOR	1096.2435.00	4		
490	FJ CAP FOR N CONECTOR	0114.1770.00	2		
492	FJ CAP FOR N CONECTOR	0114.1770.00	4		
500	ZB ACCESS. ZVB	1145.1049.00	1		
DRAWING 1145.1290.01 (BASE UNIT)					

Position.	Designation	Stock No.	Number	Electrical Designation	Recommended spare parts
500	ZM METAL FRAME ZVB	1145.1332.00	1		
505	ZM METAL FRAME ZVB 20	1302.4602.00	1		
510	ED MOTHERBOARD Mod. 08 09 20	1145.3435.02	1	A10	
511	ED MOTHERBOARD	1145.3435.03	1	A10	x
519	LABEL CE	1145.3987.00	0		
520	VS 6900/ISR-M2.5X6-A2	1148.3059.00	14		
530	FM LOCKING SCREW M3	0009.6501.00	2		
540	FM LOCKING SCREW H=4.5	1093.9180.00	2		
550	VS 965/ISR-M2.5X6-A4-PA	1148.3288.00	4		
551	EMC GASKET	1300.1806.00	2		
552	SERRATED LOCKWASHER	3583.1578.00	6		
553	HEX 14 NUT ½-28 UNEF	3583.1561.00	6		
555	MZ CASCADE PLATE	1145.4690.00	1		
580	GR FRONT MOD. CONTROLLER 6/5	1091.2908.00	1	A90	x
581	BIOS ZVAB FOR FMR7	1300.1529.00	1		
582	LITHIUM BATTERY CR2032	0858.2049.00	1		x
585	BIOS ZVAB	1145.1190.00	0		
590	VS 6900/ISR-M2.5X6-A2	1148.3059.00	10		
595	DF CABLE 4X2 AND SCHIELDING 630	1145.5115.00	1	W12	
596	DZ FEED-THROUGH RD8XRD14X8	0062.1146.00	1		
597	DZ CABLE TIE RD 1 TO 25 B2	0015.9038.00	7		
600	ZM DISPLAY UNIT AUO DISPLAY ZVB Mod. 08	1303.3400.08	1	A1	
601	ZM DISPLAY UNIT AUO DISPLAY ZVB Mod. 09	1303.3400.09	1	A1	
602	ZM DISPLAY UNIT AUO DISPLAY ZVB Mod. 20	1303.3400.20	1	A1	
605	ZM DISPLAY UNIT AUO DISPLAY ZVB Mod. 23	1303.3400.23	1	A1	
610	VS 965/ISR-M2.5X5-A4-PA	1148.2752.00	4		
670	GP 3.5 FLOPPY DRIVE SLIM	0048.6638.00	1	A30	x

Position.	Designation	Stock No.	Number	Electrical Designation	Recommended spare parts
680	MZ FLOPPY MOUNT	1093.4620.00	1		
690	DF FLEX-STRIP CONNECTOR 26P.R=1	1091.2066.00	1	W300	
700	VS 6900/ISR-M2.5X6-A2	1148.3059.00	2		
702	VS 7985/ISR-M2.5X4-A4-PA	1148.2717.00	3		
704	VS DIN127-B2.5-A4	0082.4786.00	3		
710	ZE HD WITH FIRMWARE ZVAB	1145.1178.02	1	A60	x
715	SATA DATA CABLE 265	1091.3440.00	1	W11	x
716	SATA POWER CABLE 285	1091.3427.00	1	W13	x
720	MZ DISK MOUNT	1093.4837.00	1		
725	VS 965/ISR-M2.5X6-A4-PA	1148.3288.00	2		
730	VS 965/ISR-M3X5-A4-PA	1148.2775.00	4		
735	ED AC FUSE BOARD	1145.3906.02	1	A21	x
736	MZ PROTECTION COVER	1300.0845.00	1		
737	VS 7985/ISR-M3X10-A4-PA	1148.2623.00	1		
738	OS LABEL 25MM HIGH-VOLTAGE FLASH	0042.5169.00	1		
740	DY CABLE FOR ZVBA POWER SUPPLY	1145.5544.00	1	W22	x
745	DX POWER SUPPLY CABLE 6P	1145.5515.00	1	W23	
750	DX POWER SUPPLY CABLE 8P	1145.5521.00	1	W24	
755	DX POWER SUPPLY CABLE 10P	1145.5538.00	1	W25	
756	VS DIN137-A3-A2	0005.0296.00	8		
757	VS DIN137-A4-A2	0005.0315.00	4		
758	TOOTHED LOCK WASHER	0016.2820.00	8		
759	TOOTHED LOCK WASHER	0016.2837.00	6		
760	POWER ENTRY MODULE 10ASWITCH	3587.5749.00	1	X200	x
762	ADAPTER PLATE	1313.2006.00	1		
765	VS 965/ISR-M3X8-A4-PA	1148.2798.00	2		
770	ZE POWER UNIT ZVAB	1145.3893.00	1	Z20	
771	DZ GROMMET 7X12X16	0099.3520.00	1		
772	VS 965/ISR-M3X8-A4-PA	1148.2798.00	2		

Position.	Designation	Stock No.	Number	Electrical Designation	Recommended spare parts
775	DX PE CABLE	1090.3881.00	1	W201	
778	OS LABEL RD11 EARTH SYMBOL	0042.5330.00	2		
780	VS 965/ISR-M4X10-A4-PA	1148.2823.00	2		
782	VS DIN6797-A4.3-A2	0016.2837.00	2		
784	FV FLAT CONNECTOR GR 6.3	0432.4311.00	1		
785	FV FLAT CONNECTOR GR.6.3	0438.0453.00	1		
786	VS DIN137-A4-A2	0005.0315.00	2		
787	VS DIN934-M4-A4	0016.4400.00	2		
788	OS LABEL 25MM HIGH-VOLTAGE FLASH	0042.5169.00	1		
789	MZ PROTECTION COVER	1145.3235.00	1		
790	GJ SWITCHING POWER SUPPLY	1145.5238.00	1	A20	
791	MZ POWER SUPPLY PLATE	1145.2468.00	1		
792	VS DIN433-4.3-A4	0082.4586.00	4		
793	VS 7985/ISR-M4X6-A4-PA	1148.2646.00	4		
795	VS 6900/ISR-M2.5X6-A2	1148.3059.00	8		
796	VS 965/ISR-M2.5X6-A4-PA	1148.3288.00	2		
797	HS IMAGE SOFTWARE	0048.7540.00	1		
798	HS WINDOWS XP EMBEDDED	1099.8570.00	1		
799	OS BARCODE LABEL FOR PCB	0071.7714.00	1		
DRAWING 1145.1384.01 (DISPLAY UNIT)					
800	ZM MOUNTING TROUGH ZVB4/8 3-PORT	1145.2516.00	1		
801	ZM MOUNTING TROUGH ZVB4/8 4-PORT	1145.2500.00	1		
805	ZM MOUNTING TROUGH ZVB20 3-PORT	1145.2400.00	1		
806	ZM MOUNTING TROUGH ZVB20 4-PORT	1302.4619.00	1		
807	ZM MOUNTING TROUGH ZVI	1164.1986.00	1		
808	ZM MOUNTING TROUGH ZVB14/20 2/4-PORT	1305.4855.00	1		
810	OP SCREENED FILTER GLASS UPL/UPD	1069.2144.00	1		x
820	MZ RF SPRING (177)	1069.3011.00	2		

Position.	Designation	Stock No.	Number	Electrical Designation	Recommended spare parts
830	MZ RF CLIP (137)	1069.3105.00	2		
840	MB DISK HOLDER	0852.0850.00	4		
850	VS 965/ISR-M2.5X5-A4-PA	1148.2752.00	4		
855	MM PROTECTIVE COLLAR 9.6X13.9	0852.1234.00	1		
860	FLEXIBLE SWITCH BOARD	1145.1990.00	1	A16	x
870	SB KEY PAD 68T ZVB Mod 08, 80	1145.2000.00	1	A15	x
875	SB KEY PAD ZVB 4-PORT Mod 09, 22	1145.2439.00	1	A15	x
877	SB KEY PAD 68T Mod 20	1145.5050.00	1	A15	x
878	SB KEY PAD ZVB 4-PORT Mod 23	1305.4726.00	1	A15	x
880	ZM SUPPORT PLATE ZVB 3T	1145.2522.00	1		
885	ZM SUPPORT PLATE ZVB 4T	1145.2539.00	1		
890	VS 965/ISR-M2.5X5-A4-PA	1148.2752.00	10		
895	VS 965/ISR-M2.5X5-A4-PA Mod 23	1148.2752.00	4		
905	WW ADHESIVE FOAM	0852.1805.00	.7 m		
910	BP TFT 800X600X3 8.4INCH	0048.8599.00	1	A70	x
915	MZ DISPL.HF-SHIELD	1302.4490.00	1		
920	VS 6900/ISR-M2.5X8-A2	0041.1653.00	4		
930	BP VNR-08C351-INV	0048.8760.00	1	T10	x
940	VS 6900/ISR-M2.5X6-A2	1148.3059.00	2		
950	DF CONVERTER CABLE L=310 10PIN	1091.2650.00	1	W100	x
960	EM ROTARY PULSE GENERATOR 1 (WITH KEY)	0852.2701.00	1	B10	x
980	EM COLLAR	0852.1105.00	1		
990	OK RD28 AXIS RD6	0852.1086.00	1		
1000	MZ HOLDING BRACKET FOR PCB	1145.2039.00	2		
1010	VS 965/ISR-M2.5X5-A4-PA	1148.2752.00	2		
1020	GR DISPL. CONNECTOR FMR6-TOSHIB	1091.2637.00	1		x
1030	DF DISPL. CABLE TOSHIBA	1091.2666.00	1		x

Position.	Designation	Stock No.	Number	Electrical Designation	Recommended spare parts
1040	VS 6900/ISR-M2.5X6-A2	1148.3059.00	2		
1050	ED USB BOARD	1305.3207.02	1	A40	x
1060	VS 965/ISR-M2.5X5-A4-PA	1148.2752.00	2		
DRAWING 1302.4960.08 (REFLECTOMETER UNIT 4/8 GHz)					
100	ZE RM8 BR UNIT	1145.3593.02	1	A505	x
110	ED RM8 GENERATOR	1145.4754.02	1	A504	x
120	ED RM8 RECEIVER	1145.4731.04	1	A503	
125	ED RM8 RECEIVER	1145.4731.08	1	A503	
120	ED RM8 RECEIVER 2	1302.5009.04	1	A503	x
125	ED RM8 RECEIVER 2	1302.5009.08	1	A503	x
130	MN COVER B-SIDE GEN 8GHZ	1145.3670.00	1		
140	MN COVER A-SIDE GEN 8GHZ	1302.5096.00	1		
150	MN COVER B-SIDE REC 8GHZ	1302.5109.00	1		
160	VS 965/ISR-M2.5X8-A4-PA	1148.3294.00	4		
170	MB INTAKE FUNNEL RM8GHZ	1302.5244.00	1		
180	VS 6900/ISR-M2.5X6-A2	1148.3059.00	2		
190	ZE FAN 40x40x10	1145.4590.00	1	E500	x
192	VS-DIN433-3.2-A4	0082.4570.00	4		
193	VS DIN128-A3-A2	0005.2499.00	4		
194	VS 7985/ISR-M3X16-A4	1145.5021.00	4		
200	MZ RM MOUNT ZVB	1302.5115.00	1		
210	VS 6900/ISR-M2.5X6-A2	1148.3059.00	4		
230	MZ HOLDING EXT. ZVB	1145.2251.00	1		
240	VS 965/ISR-M2.5X6-A4-PA	1148.3288.00	2		
250	OS LABEL RM8	1145.4548.00	1		
300	DW CABLE W514 GEN	1145.2616.00	1	W514	
310	DW CABLE W515 MEAS	1145.2622.00	1	W515	
320	DW CABLE W518 REF	1145.3012.00	1	W518	
330	FJ LOAD 50OHM SMA	0249.7823.00	1		

Position.	Designation	Stock No.	Number	Electrical Designation	Recommended spare parts
400	OS BARCODE LABEL FOR PCB	0071.7714.00	1		
DRAWING 1145.3593.01 SHEET 3 (BR UNIT)					
100	MB N OUTER CONDUCTOR	1045.8888.00	1		x
110	ZM INNER CONDUCTOR Unit	1302.5067.00	1		x
DRAWING 1145.4277.02 (REFLECTOMETER 20 GHz UNIT) incl. in 1145.4290.20					
10	EE REFLECTOMETER 20	1145.4254.03	1	A502	
11	EE REFLECTOMETER 20 w. o. Attenuator connector	1145.4254.02	1	A502	
20	MF COVER A-SIDE RM20	1305.4678.00	1		
30	ZE RECEIVER 20	1151.3504.02	1	A503	
40	ZE GENERATOR 20	1151.4300.02	1	A504	
42	ZE GENERATOR 20 2MHz Extension	1151.4300.03	1	A504	
45	VS DIN6900-M2.5x6	1148.3059.00	4		
50	MZ HOLDING ZVB20	1305.4803.00	4		
60	VS 965/ISR-M2.5X6-A4-PA	1148.3288.00	7		
80	ZE FAN 40x40x20	1145.4619.00	1		x
90	VS 7985/ISR-M2.5X6-A4-PA	2084.8000.00	4		
100	VS DIN125-A2.7-A4	0082.4663.00	4		
110	OS BARCODE LABEL FOR PCB	0071.7714.00	4		
150	FJ ADAPTER PC3.5 ST/ST	1127.9493.00	1	X2	
200	ZE COUPLER 24	1162.0701.02	1	A501	x
300	M COUPLER HOLDER	1145.4677.00	1		
310	MF DISTANCE PLATE RM24	1145.4490.00	1		
320	MZ SMA BRACKET ZVA24	1305.5568.00	1		
330	MZ SMA HOLDING PLATE	1305.5297.00	1		
340	VS 7985/ISR-M2.5X6-A4-PA	1148.3271.00	1		
400	VS 7985/ISR-M2.5X16-A2	1148.2869.00	2		
450	VS 965/ISR-M3X10-A4-PA	1145.2769.00	2		
500	ZE REFLECTOMETER 20	1145.4277.03	1	A500	x

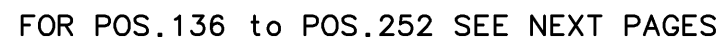
Position.	Designation	Stock No.	Number	Electrical Designation	Recommended spare parts
600	DW Cable W514A GEN	1305.5039.00	1	W514A	
650	DW Cable W514B GEN	1305.5068.00	1	W514B	
700	DW Cable W515A MEAS	1305.5045.00	1	W515A	
750	DW Cable W515B MEAS	1305.5074.00	1	W515B	
800	DW Cable W518A REF	1305.5051.00	1	W518A	
850	DW Cable W518B REF	1305.5080.00	1	W518B	
900	DV RF Cable W541	1145.4931.00	1	W541	
DRAWING 1164.1770.00 (OPTION ZVAB-B4 1164.1757.02)					
120	EE FREQ. REFERENCE	1145.3835.05	1	A100	x
296	MZ INSTRUMENT COVER ZVB	1145.1849.00	1		
298	VS 965/ISR-M2.5X6-A4-PA	1148.3288.00	33		
400	KR BW2 CASING 5E1/1T350N-ZV	1145.1826.00	1		x
405	KR CASING HOLDING HOOK	1096.4796.00	1		
460	KR BW2 REAR PANEL FOOT 50MM	1096.2493.00	4		
DRAWING 1305.6306.00 (OPTION ZVAB-B14 1305.6306.02)					
20	EE UNIVERSAL INTERFACE BOARD	1305.6312.02	1		x
30	DY CABLE	1305.6335.00	1	W245	x
40	VS COMBINATION SCREW	0048.7886.00	2		
50	VS NUT DIN 934-M3	0016.4398.00	2		
60	DZ CABLE TIE	0015.9038.00	2		
70	PD INSTALL: INSTRUCTION ZVAB-B14	1305.6341.00	1		
80	PD SAFETY INSTR. BOOKLET	1171.0100.42	1		
90	KB REAR PANEL PLATE	1145.1226.00	1		
DRAWING 1164.0715.01 (OPTION ZVAB-B18 REMOVABLE FLASH DISC)					
3000	ED COMPACT FI-BOARD S-ATA Mod 02, 03	1164.5046.02	1	A381	x
3010	ZM FLASH MEMWITH SW Mod 02 for FMR6	1164.0809.02	1	A380	x
3015	ZM FLASH MEMWITH SW Mod 03 for FMR7	1164.0809.03	1	A380	x
3020	ZM CF HOLDER ZVAB-B18 Mod 02, 03	1164.0767.00	1		

Position.	Designation	Stock No.	Number	Electrical Designation	Recommended spare parts
3030	VS COMBINATION SCREW Mod 02, 03	1148.3059.00	4		
3040	MZ CF-CARD ADAPTER PLATE Mod 02, 03	1163.0963.00	1		
3050	VS COMBINATION SCREW Mod 02, 03	1148.3059.00	3		
3060	DY FLATCABLE W11 Mod 02 for units with FMR6 only	1164.0796.00	1	W11	x
3065	DG SATA DATACABLE 420 Mod 03, 04 for units with FMR7 only	1091.3456.00	1	W11	x
3066	DF SATA POWERCABLE 440 Mod 03, 04 for units with FMR7 only	1091.3433.00	1	W13	x
3070	DZ FLAT CABLE HOLDER Mod 02	0627.2116.00	2		
3080	WT POLYETHYLEN COMPOUND Mod 02	0001.9501.00	.15m		
3085	DZ GROMMET 14X24X7	0099.1440.00	1		
3095	PD ASSEMBLY INSTRUCTION ZVAB-B18	1164.0738.00	1		
3096	PD SAFETY INSTR. BOOKLET	1171.0100.42	1		
4000	MZ HDD GUIDING Mod 04	1305.6787.00	1		x
4010	MZ HDD HOLDER Mod 04	1305.6793.00	1		x
4030	MP HOLDER Mod 04	1201.8161.00	2		
4040	FP SATA ADAPTOR Mod 04	1308.0280.00	1		x
4050	MB SPECIAL SCREW M3 Mod 04	1304.9199.00	2		x

Projektions-
methode



Projection
Method



Maßstab Scale	Toleranz Tol.		ISO2768-m		Werkstoff Material						
ROHDE&SCHWARZ	Benennung / Designation					Sprache / Lang.		Aei. / C.I.		Blatt / Sh.	
	ZVB NETWORK ANALYZER					en		07.00		1	
	ZVB					Zeichn.Nr. / Drawing No.					
	Datum Date	2012-03-29		Abteilung Dept.	MTEK		Name Name	hm		1145.1010.01 D	

Für dieses Dokument behalten wir uns alle Rechte vor
For this document all rights are reserved

Projektions-
methode
Projection
Method

164 MOD06,10 see connector designation
of cables and motherboard
for cable mounting

VIEW A

VIEW A

THIS PAGE IS ONLY FOR
MOD06,10

Maßstab Scale	Toleranz Tol.	Werkstoff Material	Sprache / Lang. Ael. / C.I.			Blatt / Sh.
ROHDE&SCHWARZ	Benennung / Designation	ZVB NETWORK ANALYZER	en	02.00	2	
Datum Date	2005-04-07	Abteilung Dept.	1ESK	Name Name	Wn	Zeichn.Nr. / Drawing No. 1145.1010.01

Für dieses Dokument behalten wir uns alle Rechte vor
For this document all rights are reserved

Projektions-
methode
Projection
Method

166 MOD04,08 } see connector designation
158 MOD05,09 } of cables and motherboard
for cable mounting

VIEW A

VIEW A

THIS PAGE IS ONLY FOR
MOD04,05,08,09

Maßstab Scale	Toleranz Tol.	Werkstoff Material	Sprache / Lang. Ael. / C.I.	Blatt / Sh.
ROHDE&SCHWARZ	Benennung / Designation ZVB NETWORK ANALYZER		en 02.00	3
Datum Date	2005-04-07	Abteilung Dept.	1ESK	Name Name Wn
				Zeichn.Nr. / Drawing No. 1145.1010.01 D

Für dieses Dokument behalten wir uns alle Rechte vor
For this document all rights are reserved

Projektions-
methode
Projection
Method

see connector designation
of cables and motherboard
for cable mounting

VIEW A

VIEW A

THIS PAGE IS ONLY FOR
MOD20, 21

Maßstab Scale	Toleranz Tol.	Werkstoff Material	Sprache / Lang. Ael. / C.I.		
Benennung / Designation			en	02.00	4
ROHDE&SCHWARZ			Blatt / Sh.		
Datum Date			Zeichn.Nr. / Drawing No.		
2005-04-07			1145.1010.01		
Abteilung Dept.			1ESK	Name Name	Wn

Für dieses Dokument behalten wir uns alle Rechte vor
For this document all rights are reserved

Projektions-
methode
Projection
Method

200 see connector designation
of cables and motherboard
for cable mounting

VIEW A

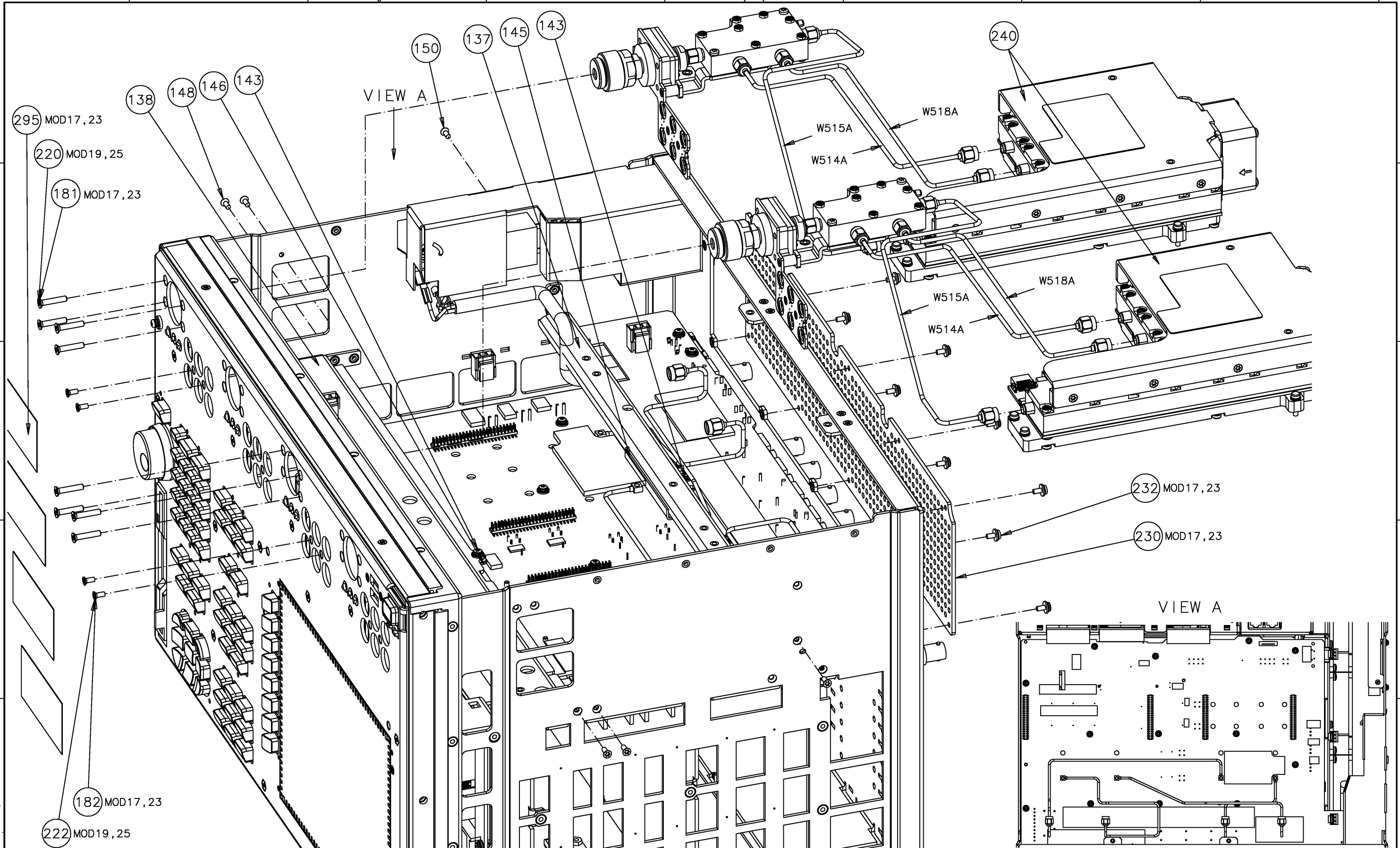
VIEW A

THIS PAGE IS ONLY FOR MOD22

Maßstab Scale	Toleranz Tol.	Werkstoff Material	Sprache / Lang. Ael. / C.I.	Blatt / Sh.
ROHDE&SCHWARZ	Benennung / Designation	ZVB NETWORK ANALYZER	de en 02.00	5
ZVB	Datum Date	2007-02-08	Abteilung Dept.	1ESK
	Name Name	Wn	Zeichn.Nr. / Drawing No.	1145.1010.01 D

Für dieses Dokument behalten wir uns alle Rechte vor
For this document all rights are reserved

Projektions-
methode
Projection
Method



(242) MOD17,23 see connector designation of cables and motherboard for cable mounting.
(252) MOD19,25 The correct order of the mounting for Pos.252 is W158,W159,W169,W166,W156,W155,W165,W168

THIS PAGE IS ONLY FOR MOD17,19,23,25
FOR MOD19 and 25 SEE PAGE 7 TO

Maßstab Scale	Toleranz Tol.	Werkstoff Material	Sprache / Lang. Ael. / C.I.			Blatt / Sh.
ROHDE&SCHWARZ	Benennung / Designation	ZVB NETWORK ANALYZER	de en	03.00	6	
ZVB	Datum Date	2007-03-26	Abteilung Dept.	1ESK	Name Name	Wn
						1145.1010.01 D

Für dieses Dokument behalten wir uns alle Rechte vor
For this document all rights are reserved

Projektions-
methode
Projection
Method

VIEW A

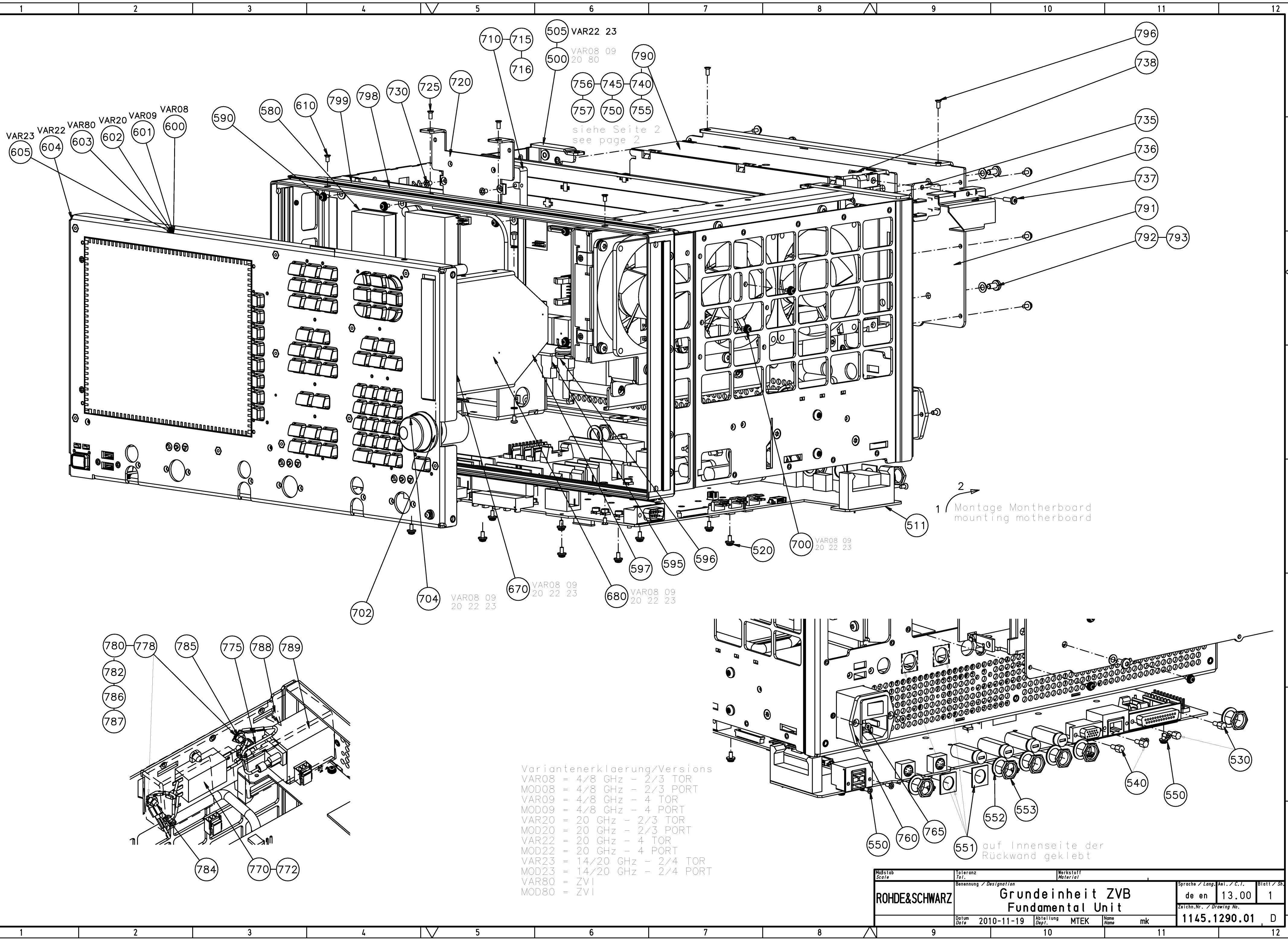
VIEW A

THIS PAGE IS ONLY FOR MOD19,25

Maßstab Scale	Toleranz Tol.	Werkstoff Material	Sprache / Lang. Ael. / C.I.			Blatt / Sh.
ROHDE&SCHWARZ	Benennung / Designation	ZVB NETWORK ANALYZER	de en	02.00		7
ZVB	Datum Date	2007-02-20	Abteilung Dept.	1ESK	Name Name	Wn
						1145.1010.01 D

Für dieses Dokument behalten wir uns alle Rechte vor
For this document all rights are reserved

Projektions-
methode
Projection
Method

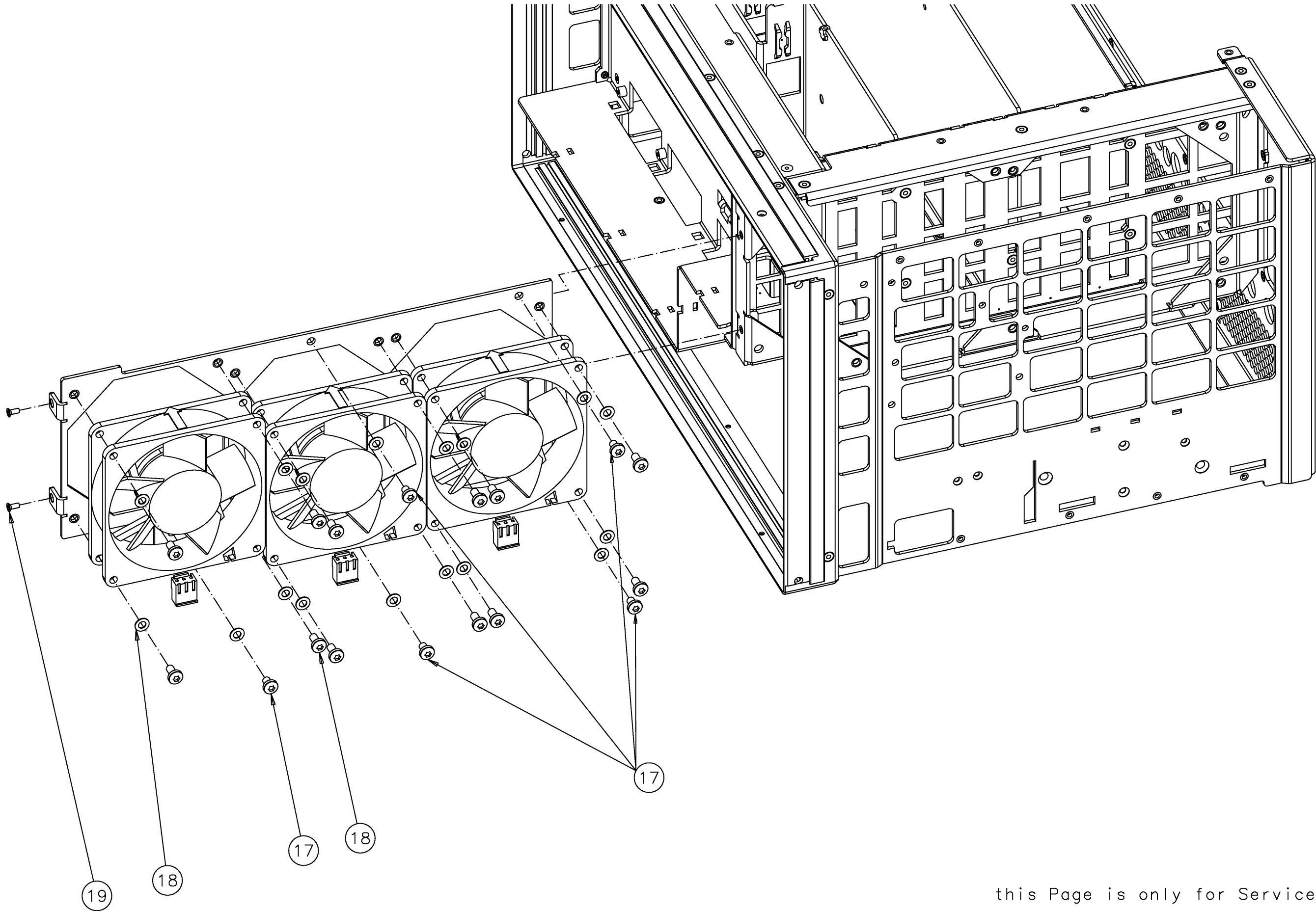


Variantenerklärung/Versions
VAR08 = 4/8 GHz - 2/3 TOR
MOD08 = 4/8 GHz - 2/3 PORT
VAR09 = 4/8 GHz - 4 TOR
MOD09 = 4/8 GHz - 4 PORT
VAR20 = 20 GHz - 2/3 TOR
MOD20 = 20 GHz - 2/3 PORT
VAR22 = 20 GHz - 4 TOR
MOD22 = 20 GHz - 4 PORT
VAR23 = 14/20 GHz - 2/4 TOR
MOD23 = 14/20 GHz - 2/4 PORT
VAR80 = ZVI
MOD80 = ZVI

Maßstab Scale	Toleranz Tol.	Werkstoff Material	Sprache / Lang. / Ael. / C.I.	Blatt / Sh.
ROHDE&SCHWARZ	Benennung / Designation	Grundeinheit ZVB Fundamental Unit	de en 13.00	1
Datum Date	Abteilung Dept.	Name Name	Zeichn.Nr. / Drawing No.	
2010-11-19	MTEK	mk	1145.1290.01	D

Für dieses Dokument behalten wir uns alle Rechte vor
For this document all rights are reserved

Projektions-
methode
Projection
Method

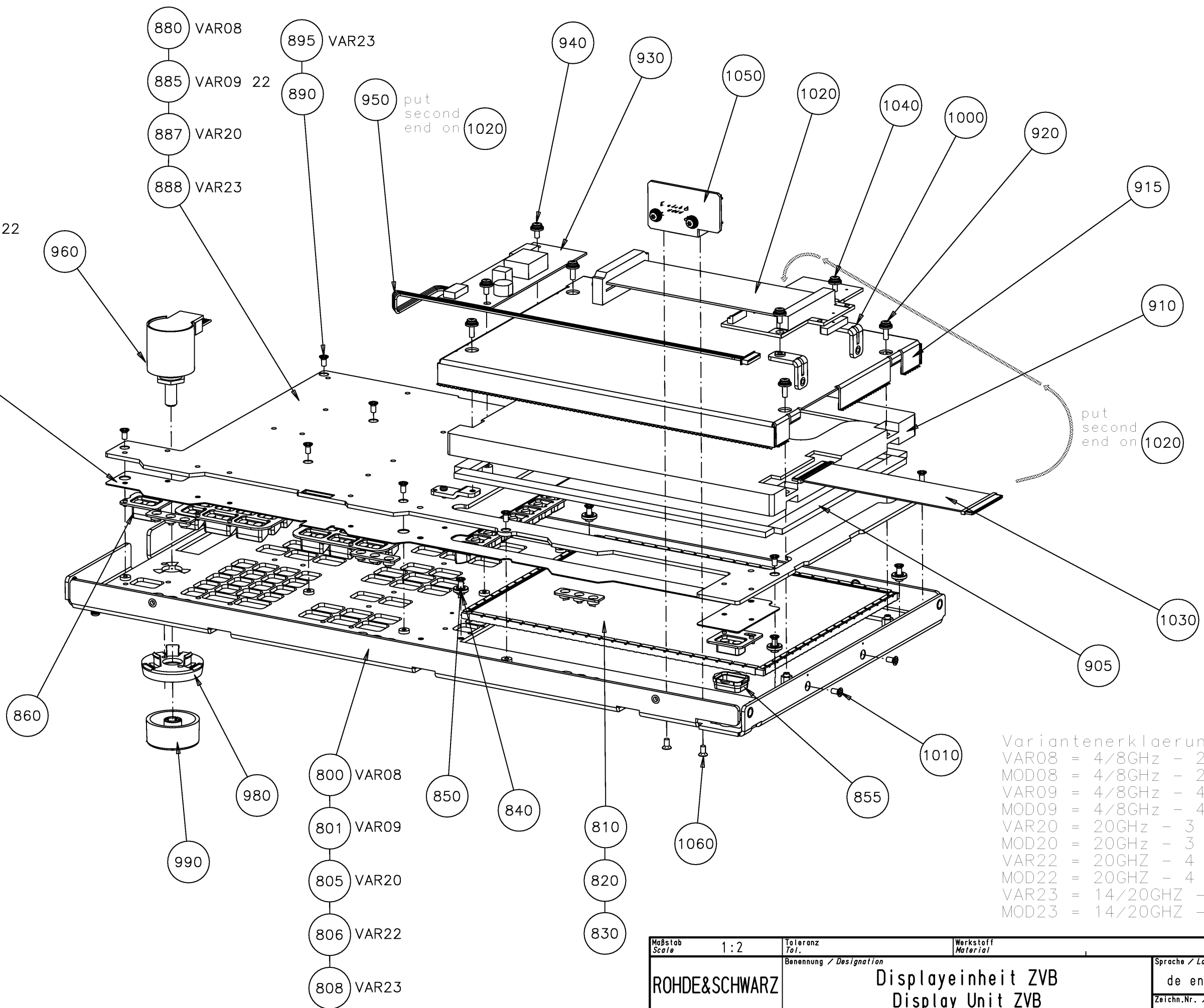


this Page is only for Servicemanual

Maßstab Scale	Toleranz Tol.	Werkstoff Material	Sprache / Lang. Aei. / C.I.		Blatt / Sh.
ROHDE&SCHWARZ	Benennung / Designation	Geraeterahmen ZVB Metal Frame ZVB	de en	01.00	2
Datum Date	15.06.2004	Abteilung Dept.	1ESK	Name Name	Fr.
			Zeichn.Nr. / Drawing No.		1145.1332.00 D

Für dieses Dokument behalten wir uns alle Rechte vor
For this document all rights are reserved

Projektions-
methode
Projection
Method

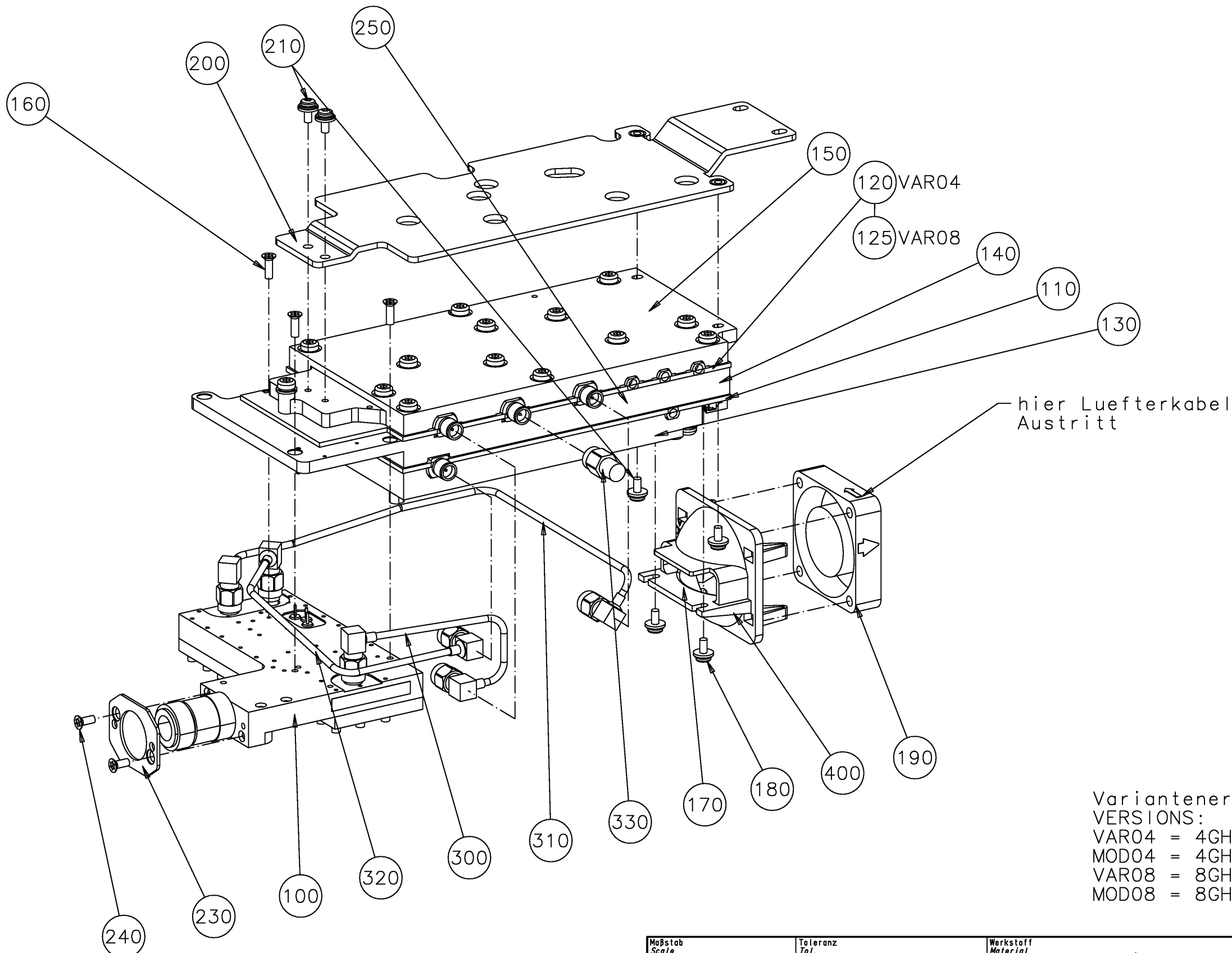


Variantenerklärung/Versions
VAR08 = 4/8GHz - 2/3 TOR
MOD08 = 4/8GHz - 2/3 PORT
VAR09 = 4/8GHz - 4 TOR
MOD09 = 4/8GHz - 4 PORT
VAR20 = 20GHz - 3 TOR
MOD20 = 20GHz - 3 PORT
VAR22 = 20GHz - 4 TOR
MOD22 = 20GHz - 4 TOR
VAR23 = 14/20GHz - 2/4 TOR
MOD23 = 14/20GHz - 2/4 TOR

Maßstab Scale	1:2	Toleranz Tol.	Werkstoff Material	Sprache / Lang. Ael. / C.I.	Blatt / Sh.
Benennung / Designation		ROHDE&SCHWARZ		de en	07.00
Displayeinheit ZVB		Display Unit ZVB		1145.1384.01	1
ZVB		Datum Date	2007-10-19	Abteilung Dept.	1ESK
		Name Name	Wn	D	

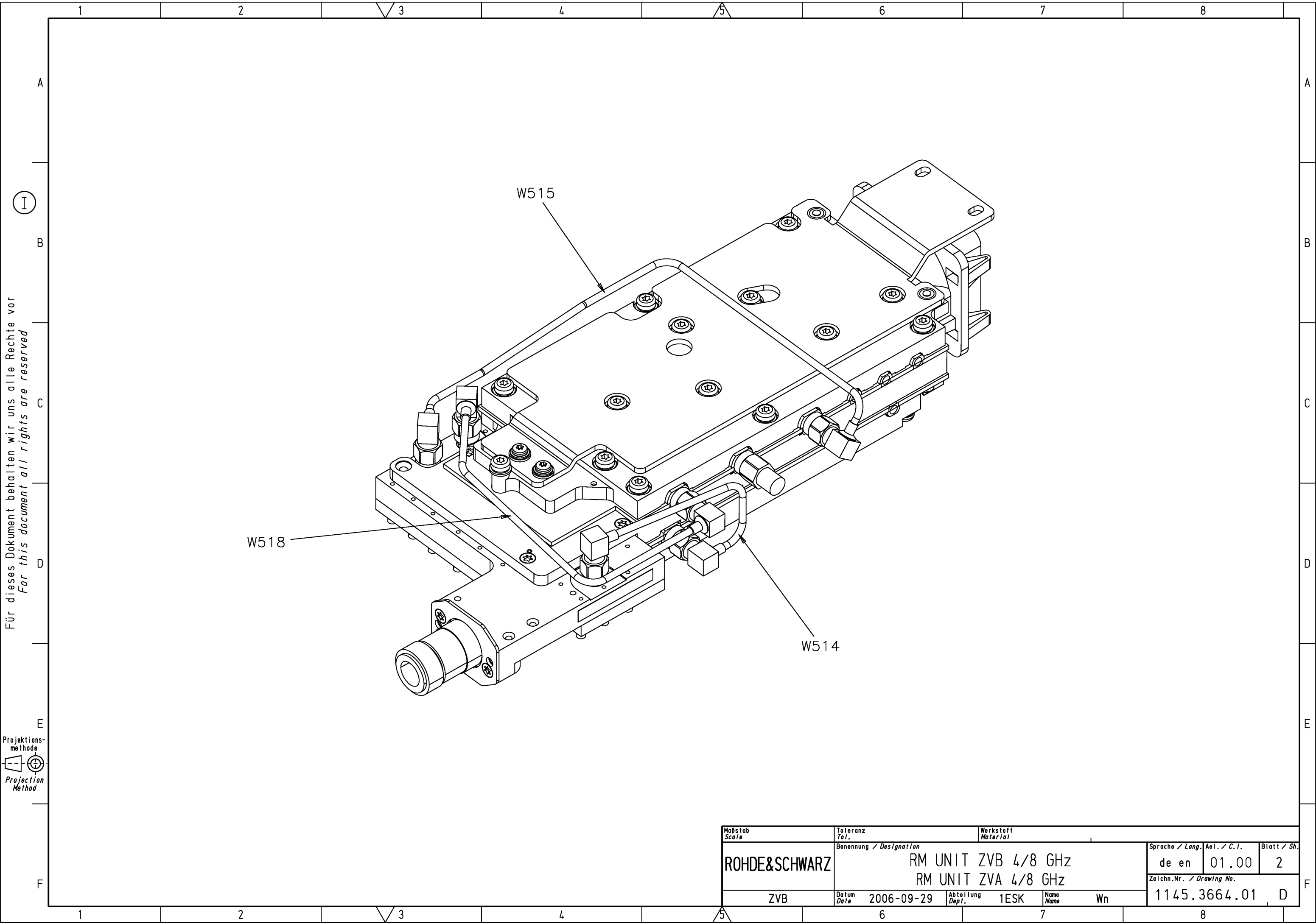
Für dieses Dokument behalten wir uns alle Rechte vor
For this document all rights are reserved

Projektions-
methode
Projection
Method



Variantenerklaerung/
VERSIONS:
VAR04 = 4GHz
MOD04 = 4GHz
VAR08 = 8GHz
MOD08 = 8GHz

Maßstab Scale	Toleranz Tol.	Werkstoff Material	Sprache / Lang. Ael. / C.I.			Blatt / Sh.
ROHDE&SCHWARZ	Benennung / Designation	RM UNIT ZVB 4/8 GHz RM UNIT ZVA 4/8 GHz		de en	04.00	1
ZVB	Datum Date	2006-09-29	Abteilung Dept.	1ESK	Name Name	Wn
			Zeichn.Nr. / Drawing No.			1145.3664.01 D



Für dieses Dokument behalten wir uns alle Rechte vor
For this document all rights are reserved

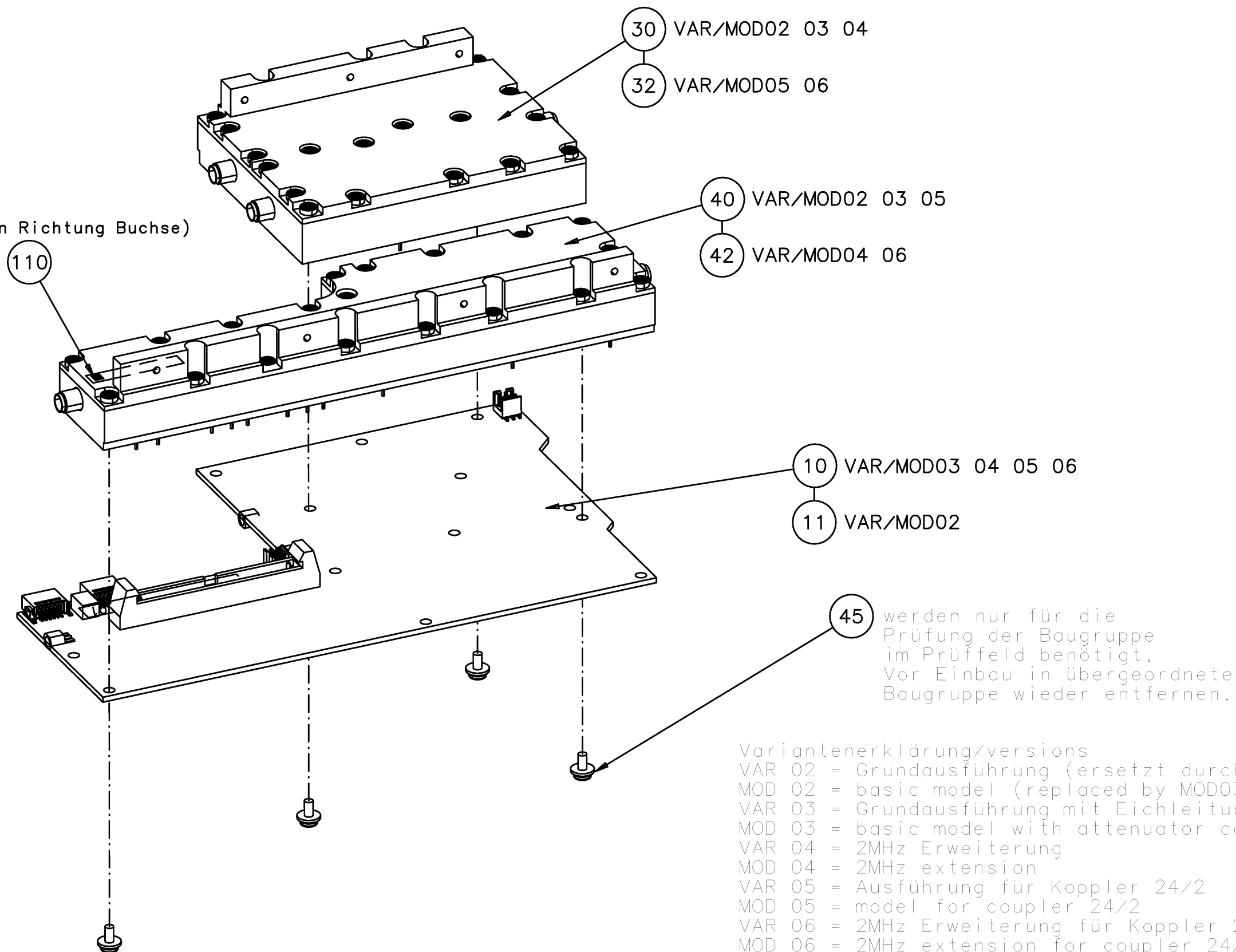
Projektions-
methode
Projection
Method

Maßstab Scale	Toleranz Tol.		Werkstoff Material				
ROHDE&SCHWARZ	Benennung / Designation			Sprache / Lang.		Aei. / C.I.	Blatt / Sh.
	RM UNIT ZVB 4/8 GHz			de en		01.00	2
	RM UNIT ZVA 4/8 GHz			Zeichn.Nr. / Drawing No.			
ZVB	Datum Date	2006-09-29	Abteilung Dept.	1ESK	Name Name	Wn	1145.3664.01 D

Für dieses Dokument behalten wir uns alle Rechte vor
For this document all rights are reserved

Projektions-
methode
Projection
Method

Barcode
(Strichcode in Richtung Buchse)

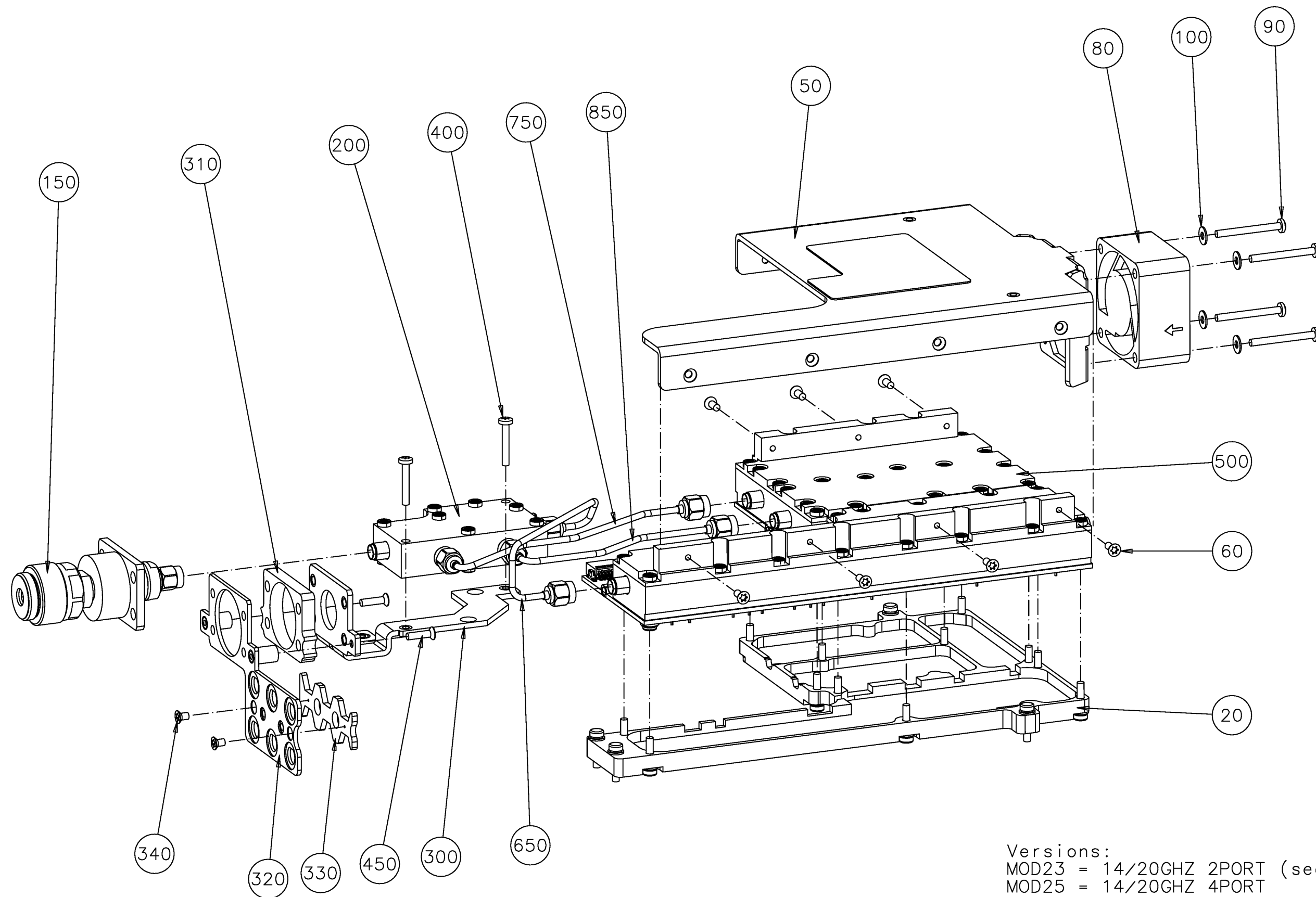


Variantenerklärung/versions
VAR 02 = Grundauführung (ersetzt durch VAR03)
MOD 02 = basic model (replaced by MOD03)
VAR 03 = Grundauführung mit Eichleistungsstecker
MOD 03 = basic model with attenuator connector
VAR 04 = 2MHz Erweiterung
MOD 04 = 2MHz extension
VAR 05 = Ausführung für Koppler 24/2
MOD 05 = model for coupler 24/2
VAR 06 = 2MHz Erweiterung für Koppler 24/2
MOD 06 = 2MHz extension for coupler 24/2

Maßstab Scale	Benennung / Designation	Toleranz Tol.	Werkstoff Material	Sprache / Lang.	Akt. / C.I.	Blatt / Sh.
ROHDE&SCHWARZ	REFLECTOMETER 20			de en	08.00	1
	Datum Date	2010-04-08	Abteilung Dept.	MTEK	Name Name	mk
						1145.4277.01 D

Für dieses Dokument behalten wir uns alle Rechte vor
For this document all rights are reserved

Projektions-
methode
Projection
Method



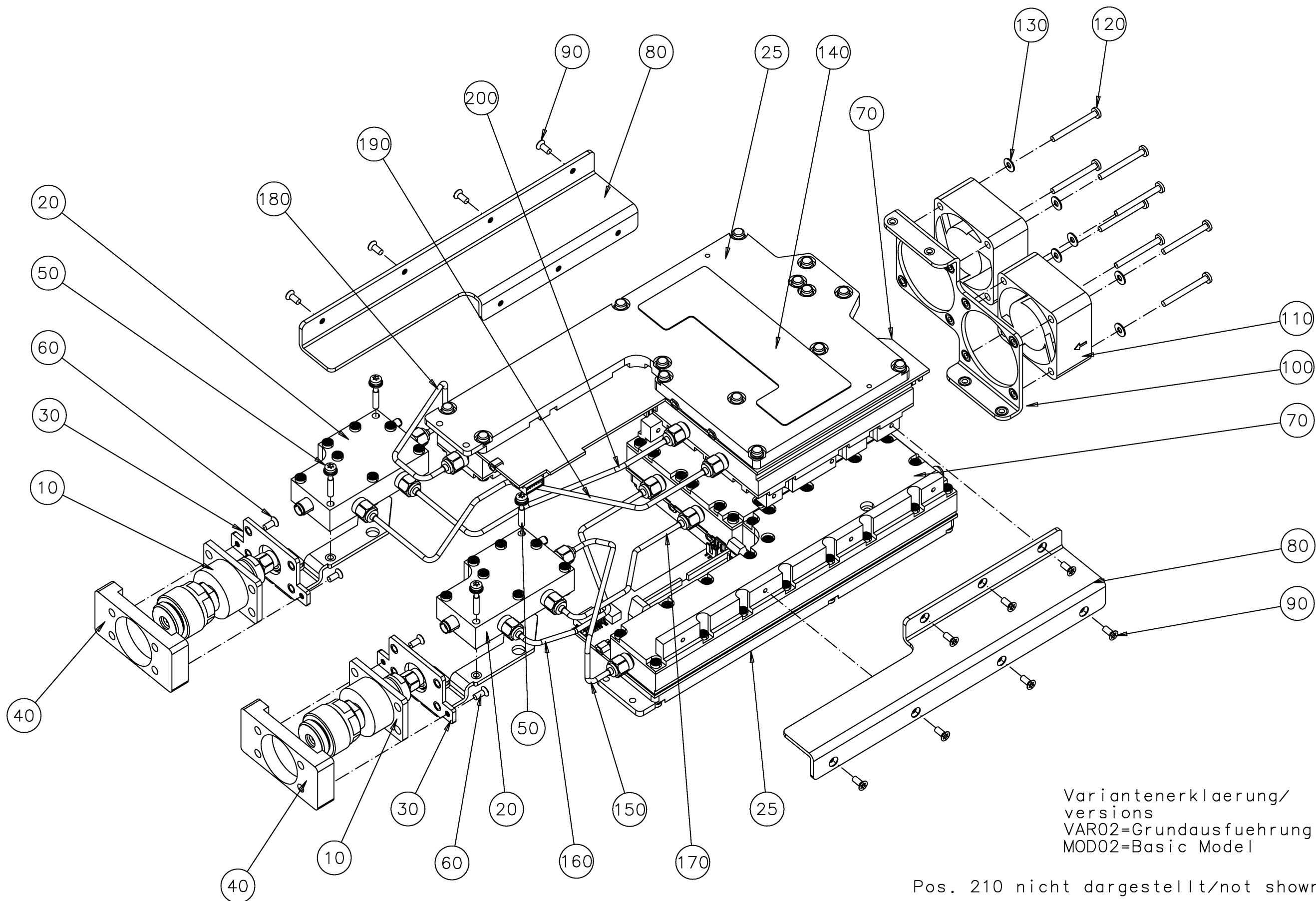
Pos.900 not shown

Versions:
MOD23 = 14/20GHZ 2PORT (see page 1)
MOD25 = 14/20GHZ 4PORT

Maßstab Scale	Toleranz Tol.	Werkstoff Material	Sprache / Lang. Ael. / C.I.			Blatt / Sh.
ROHDE&SCHWARZ	Benennung / Designation	RM UNIT ZVB 14/20GHZ RM UNIT ZVB 14/20GHZ	de en	02.00	2	
ZVAB	Datum Date	2007-07-26	Abteilung Dept.	1ESK	Name Name	Wn
			Zeichn.Nr. / Drawing No.			1305.4790.01 D

Für dieses Dokument behalten wir uns alle Rechte vor
For this document all rights are reserved

Projektions-
methode
Projection
Method



Variantenerklärung/
versions
VAR02=Grundausführung
MOD02=Basic Model

Pos. 210 nicht dargestellt/not shown

Maßstab Scale	Toleranz Tol.	Werkstoff Material	Sprache / Lang. Ael. / C.I.			Blatt / Sh.
ROHDE&SCHWARZ	Benennung / Designation	2RM UNIT ZVB 20 GHz		de en	01.00	1
ZVB	Datum Date	2005-09-26	Abteilung Dept.	1ESK	Name Name	PA/WN
			Zeichn.Nr. / Drawing No.		1302.4425.01	

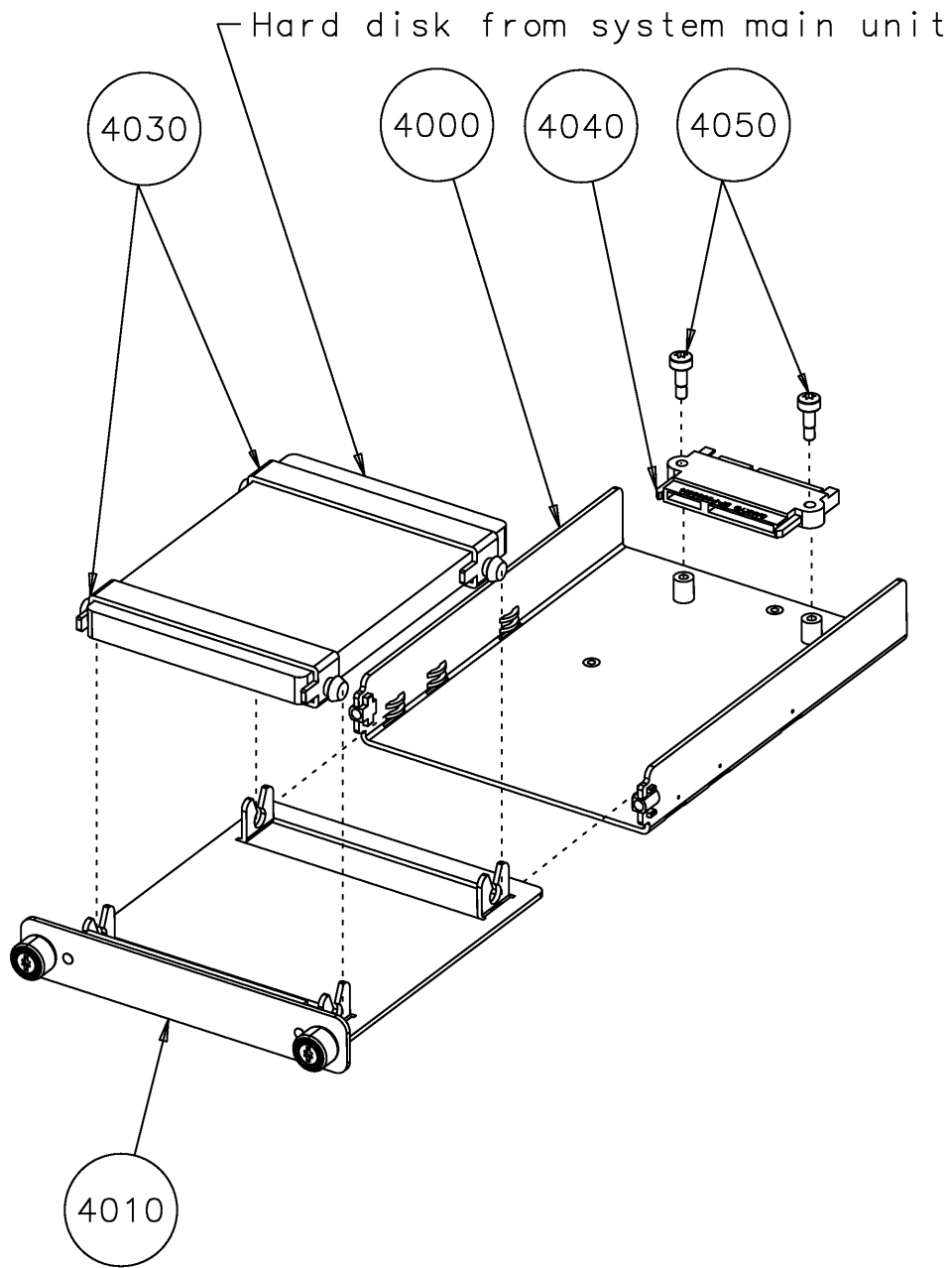
F



Maßstab Scale	1:2	Toleranz Tol.	ISO2768-m		Werkstoff Material			
ROHDE&SCHWARZ	Benennung / Designation				Sprache / Lang.		Aei. / C.I.	Blatt / Sh.
	Displayeinheit AUO DISPLAY ZVB Display Unit AUO DISPLAY ZVB				de en		01.00	1
ZVB	Datum Date	2011-03-30	Abteilung Dept.	MTEK	Name Name	WU		
					Zeichn.Nr. / Drawing No.			
					1303.3400.01 D			

Für dieses Dokument behalten wir uns alle Rechte vor
For this document all rights are reserved

Projektions-
methode
Projection
Method

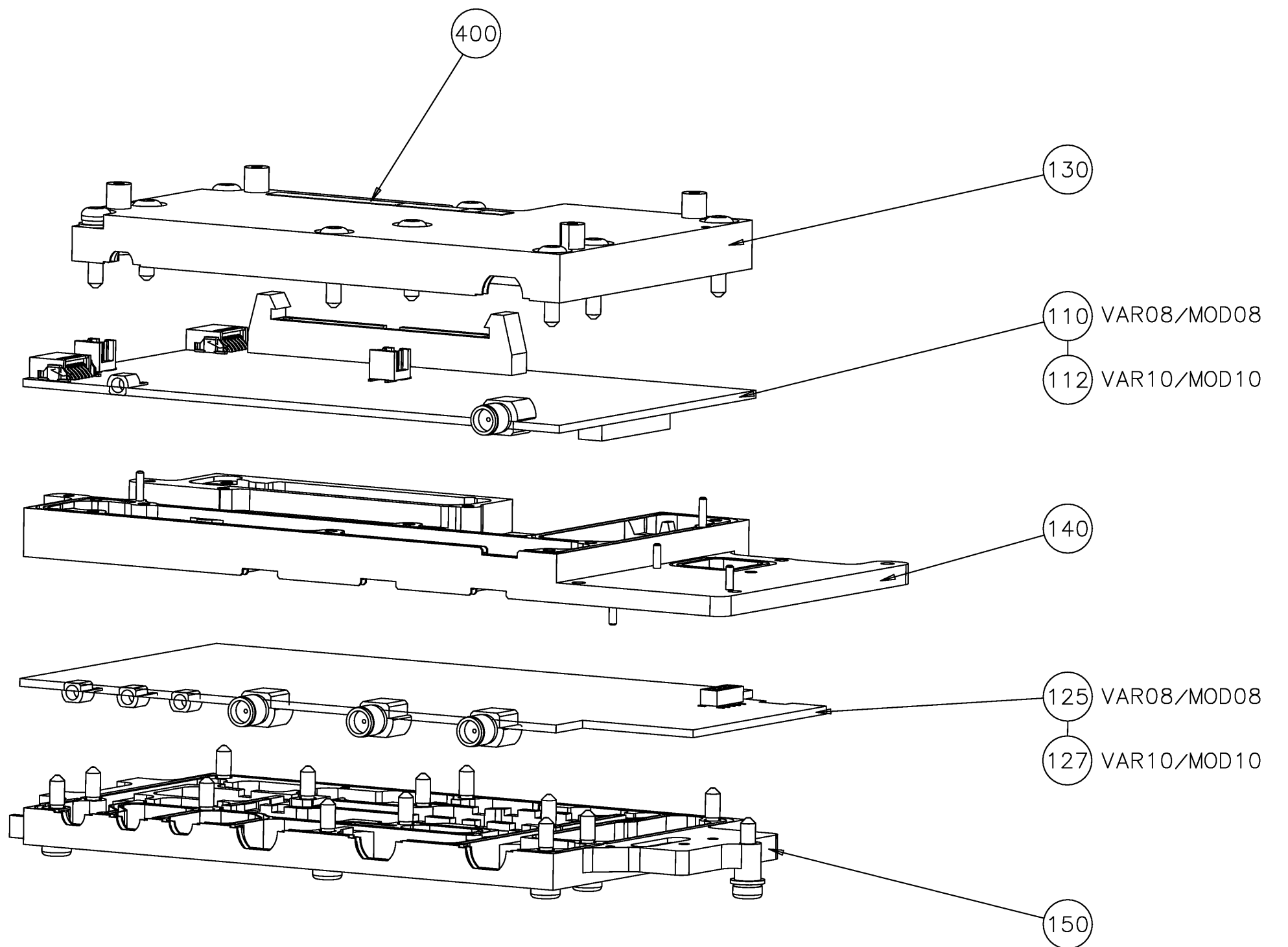


VAR 04
MOD 04

Maßstab Scale	1:2	Toleranz Tol.	TVR400	Werkstoff Material		Sprache / Lang.	de en	Äsl. / C.I.	01.00	Blatt / Sh.	1
Benennung / Designation		ZVAB-B18 FLASH-WECHSELFESTPLATTE ZVAB-B18 REMOVABLE FLASH DISC				Zeichn.Nr. / Drawing No.		1164.0715.01			D
ZVA-B18	Datum Date	2010-03-10	Abteilung Dept.	1ESK	Name Name	RN					

Für dieses Dokument behalten wir uns alle Rechte vor
For this document all rights are reserved

Projektions-
methode
Projection
Method

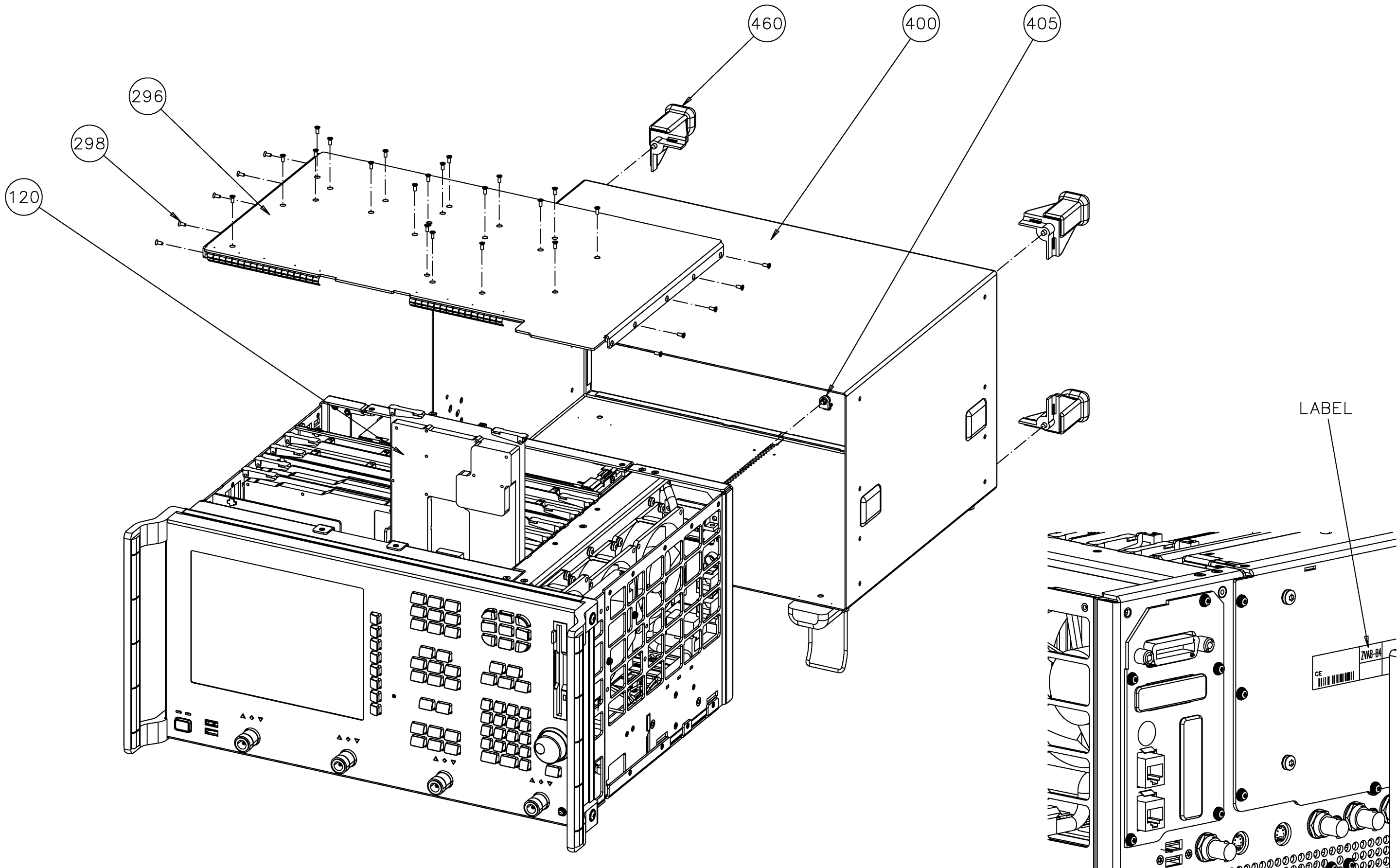


VARIANTENERKLÄRUNG/
EXPLANATION OF MODELS
VAR08 = 8GHz
MOD08 = 8GHz
VAR10 = ZVAR-AUSFÜHRUNG
MOD10 = ZVAR MODEL

Maßstab Scale	1:1	Toleranz Tol.	ISO2768-m	Werkstoff Material		Sprache / Lang.	Ael. / C.I.	Blatt / Sh.
Benennung / Designation		RM SUBUNIT ZVAB 4/8GHz				de en	01.00	1
ZVAB		RM SUBUNIT ZVAB 4/8GHz				Zeichn.Nr. / Drawing No.		
Datum Date		2009-04-14	Abteilung Dept.	1ESK	Name Name	Wn	1302.4990.01	D

Für dieses Dokument behalten wir uns alle Rechte vor
For this document all rights are reserved

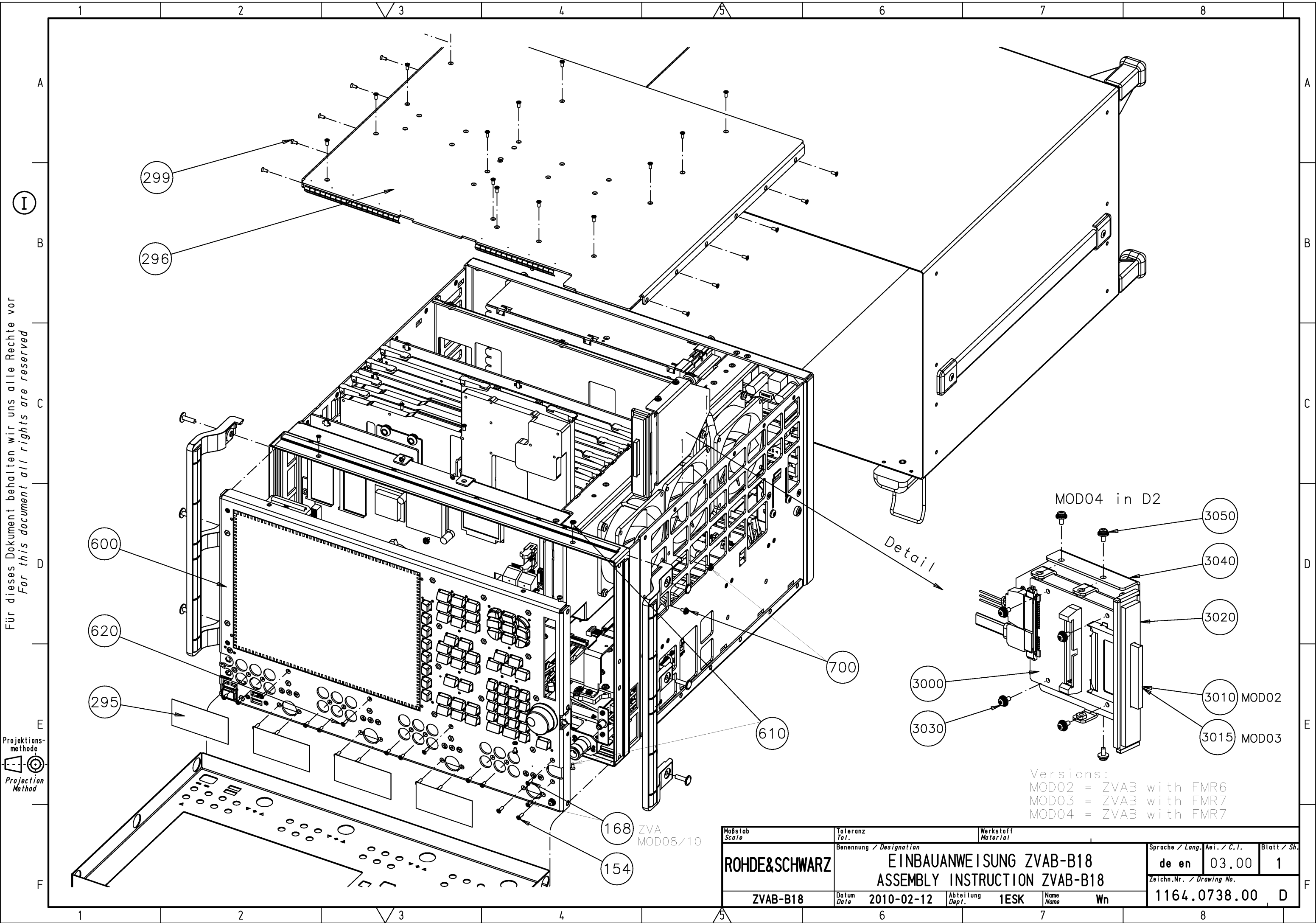
Projektions-
methode
Projection
Method



Maßstab Scale	Toleranz Tol.	Werkstoff Material	Sprache / Lang. Aei. / C.I.			Blatt / Sh.
ROHDE&SCHWARZ	Benennung / Designation	Einbauanweisung ZVAB-B4 INSTALL. INSTR. ZVAB-B4			en	1
Datum Date	04.05.2004	Abteilung Dept.	1ESK	Name Name	FR	Zeichn.Nr. / Drawing No. 1164.1770.00
						D

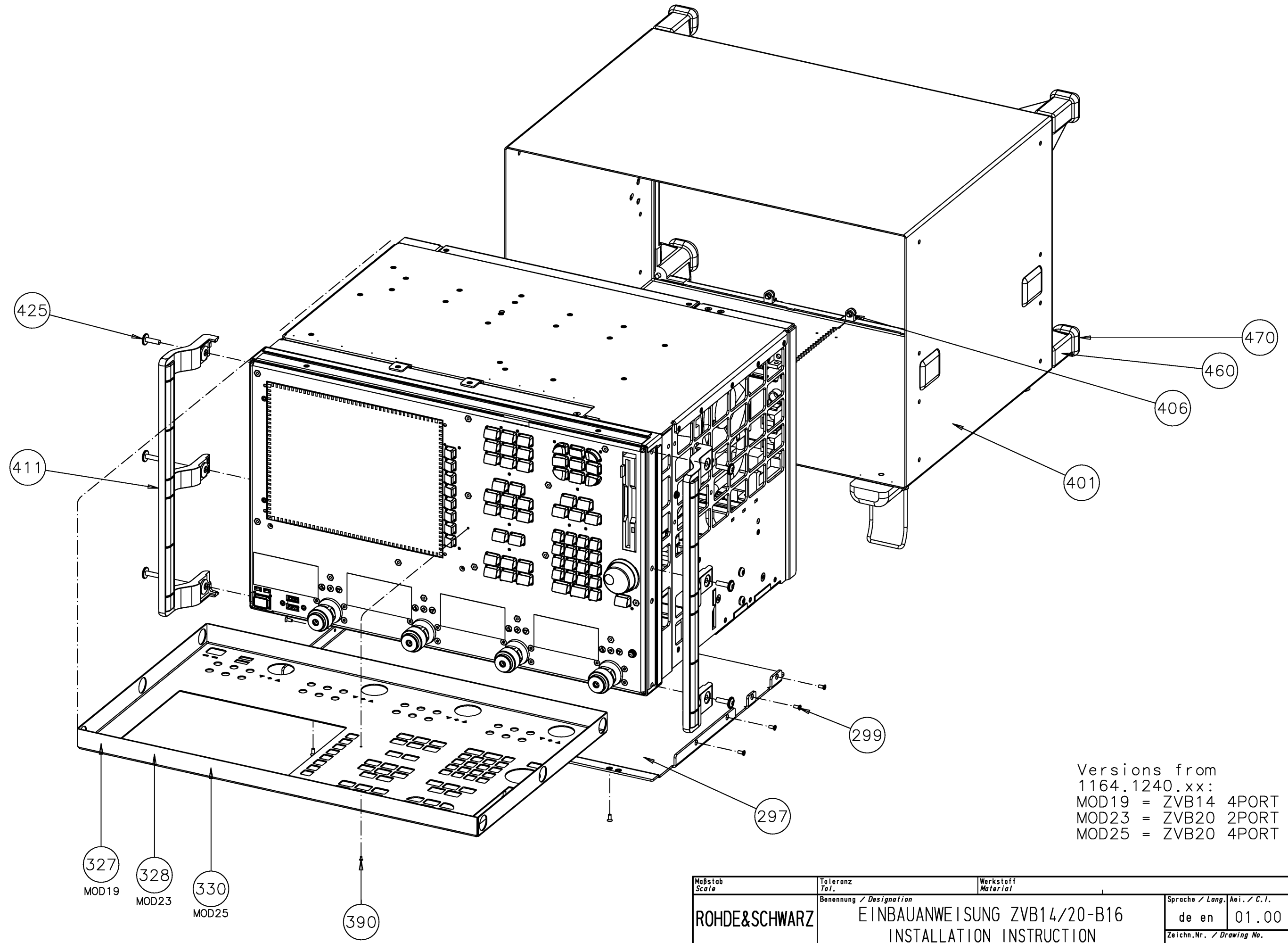
Für dieses Dokument behalten wir uns alle Rechte vor
For this document all rights are reserved

Projektions-
methode
Projection
Method



Für dieses Dokument behalten wir uns alle Rechte vor
For this document all rights are reserved

Projektions-
methode
Projection
Method



Versions from
1164.1240.xx:
MOD19 = ZVB14 4PORT
MOD23 = ZVB20 2PORT
MOD25 = ZVB20 4PORT

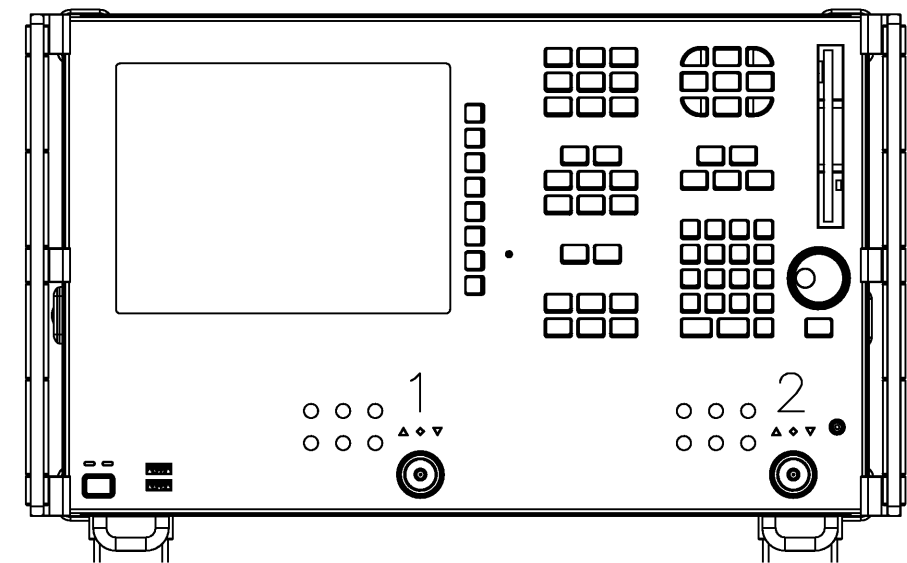
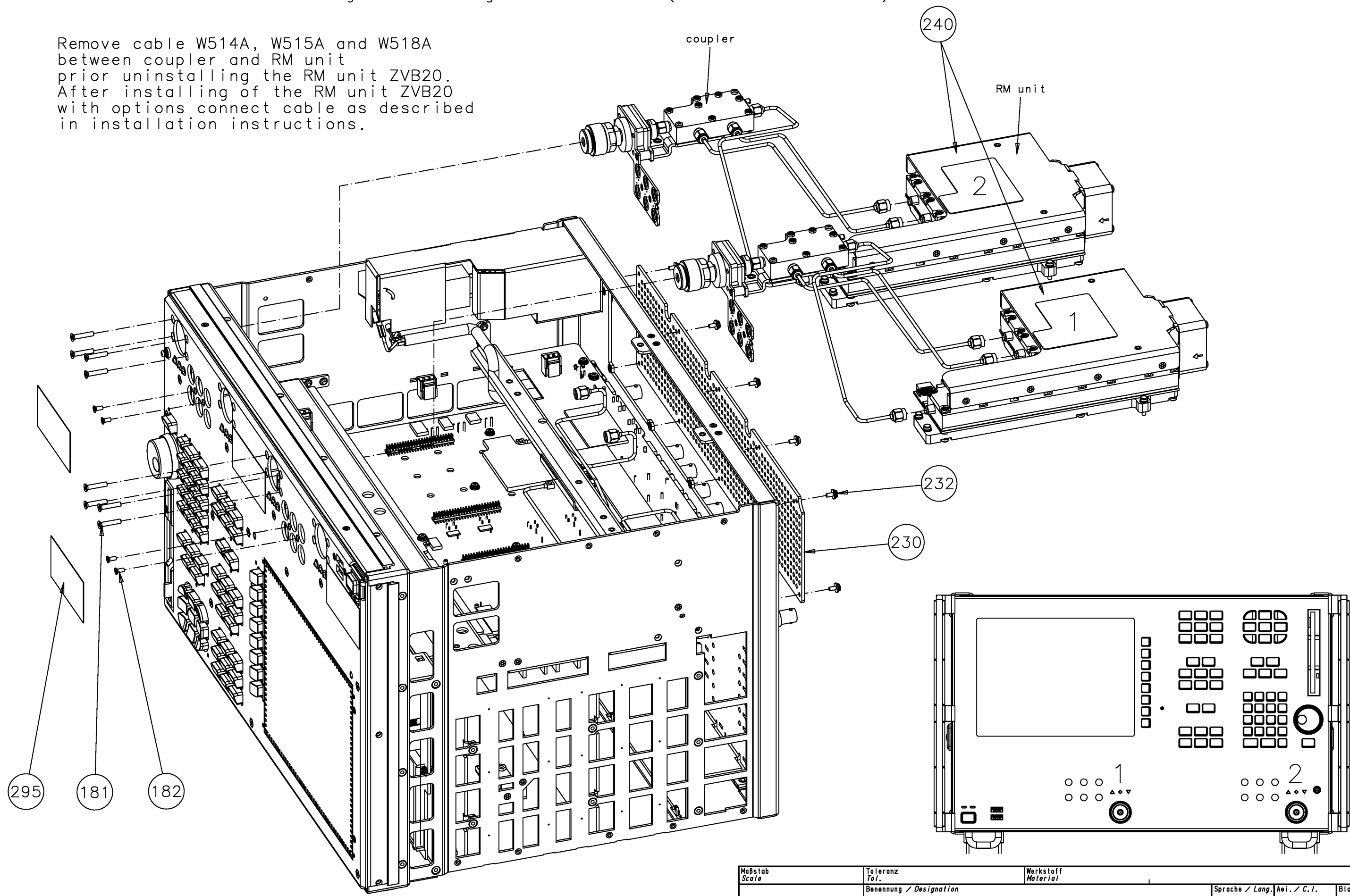
Maßstab Scale	Toleranz Tol.	Werkstoff Material	Sprache / Lang. Ael. / C.I.			Blatt / Sh.
ROHDE&SCHWARZ	Benennung / Designation	EINBAUANWEISUNG ZVB14/20-B16		de en	01.00	1
ZVB	Datum Date	2007-02-14	Abteilung Dept.	1ESK	Name Name	Wn
			Zeichn.Nr. / Drawing No.		1164.1257.00 D	

Für dieses Dokument behalten wir uns alle Rechte vor
For this document all rights are reserved

Projektions-
methode
Projection
Method

Installing/uninstalling reflectometers (RM Unit ZVB20 2Port)

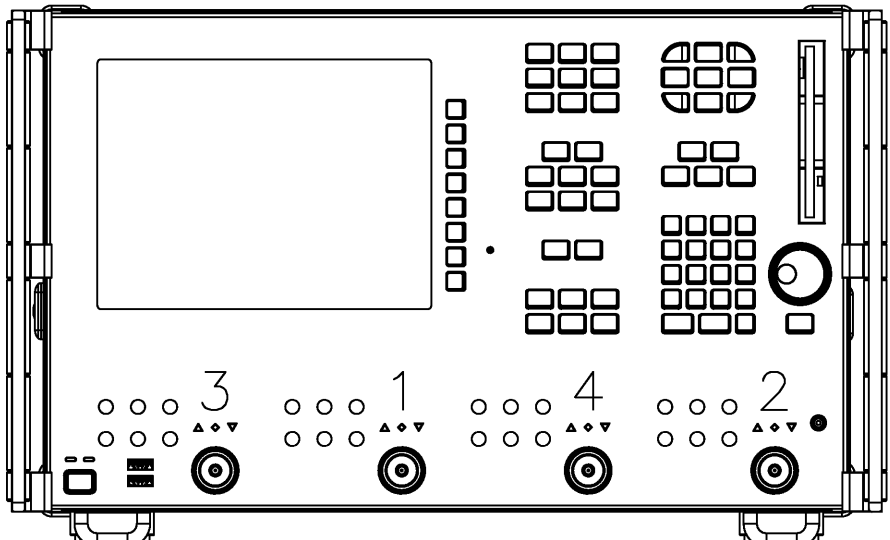
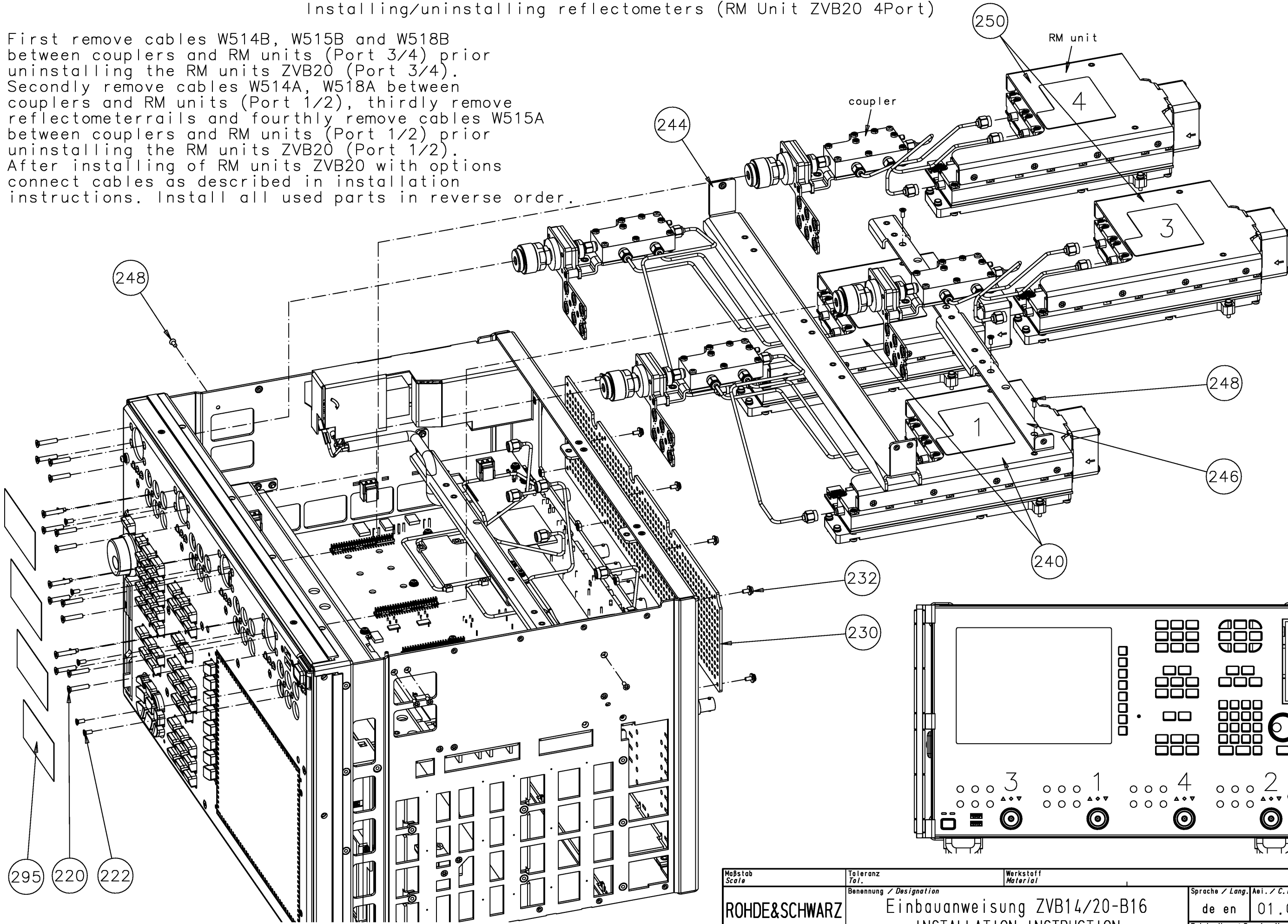
Remove cable W514A, W515A and W518A
between coupler and RM unit
prior uninstalling the RM unit ZVB20.
After installing of the RM unit ZVB20
with options connect cable as described
in installation instructions.



Maßstab Scale	Toleranz Tol.	Werkstoff Material	Benennung / Designation			Sprache / Lang. Ael. / C.I.		Blatt / Sh.
ROHDE&SCHWARZ			Einbauanweisung ZVB14/20-B16 INSTALLATION INSTRUCTION			de en	01.00	2
ZVB	Datum Date	2007-02-14	Abteilung Dept.	1ESK	Name Name	Wn	Zeichn.Nr. / Drawing No. 1164.1257.00	

Installing/uninstalling reflectometers (RM Unit ZVB20 4Port)

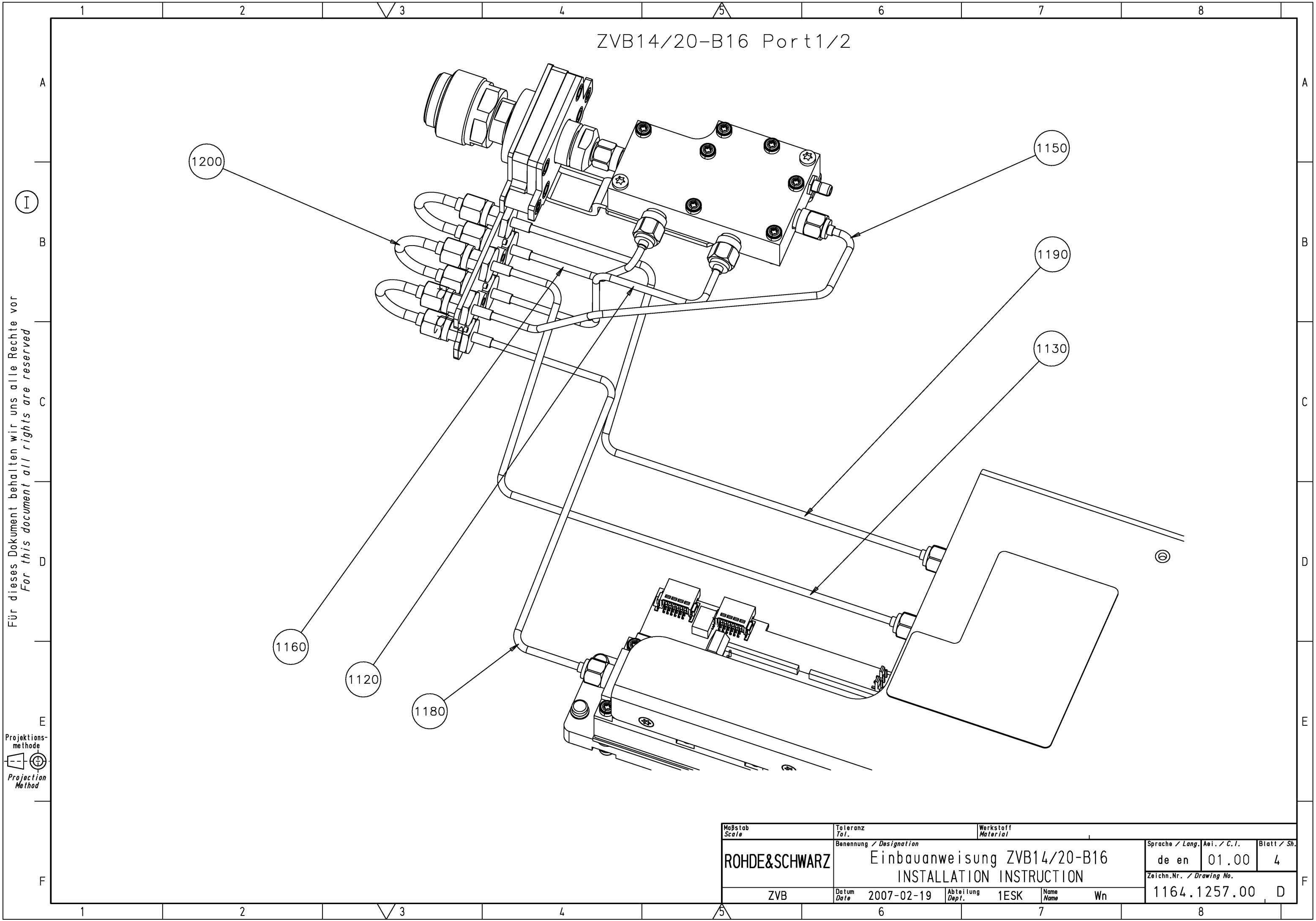
First remove cables W514B, W515B and W518B between couplers and RM units (Port 3/4) prior uninstalling the RM units ZVB20 (Port 3/4). Secondly remove cables W514A, W518A between couplers and RM units (Port 1/2), thirdly remove reflectometer rails and fourthly remove cables W515A between couplers and RM units (Port 1/2) prior uninstalling the RM units ZVB20 (Port 1/2). After installing of RM units ZVB20 with options connect cables as described in installation instructions. Install all used parts in reverse order.



Für dieses Dokument behalten wir uns alle Rechte vor
For this document all rights are reserved

Projektions-
methode
Projection
Method

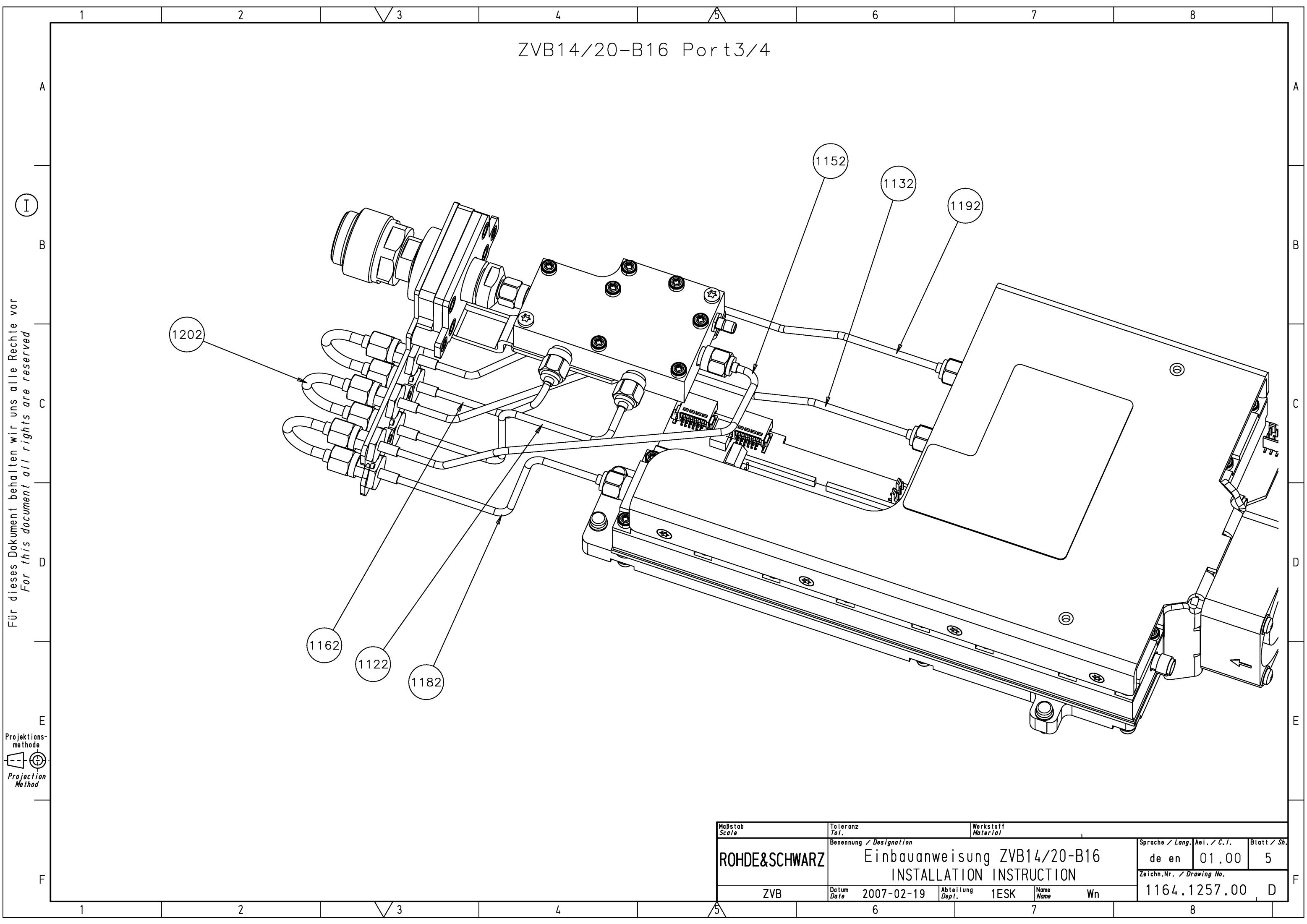
Maßstab Scale	Toleranz Tol.	Werkstoff Material	Sprache / Lang. Ael. / C.I.	Blatt / Sh.
ROHDE&SCHWARZ	Benennung / Designation	Einbauanweisung ZVB14/20-B16 INSTALLATION INSTRUCTION	de en 01.00	3
ZVB	Datum Date	2007-02-15	Abteilung Dept.	1ESK
	Name Name	Wn	Zeichn.Nr. / Drawing No.	1164.1257.00



Für dieses Dokument behalten wir uns alle Rechte vor
For this document all rights are reserved

Projektions-
methode
Projection
Method

Maßstab Scale	Toleranz Tol.	Werkstoff Material			
ROHDE&SCHWARZ	Benennung / Designation		Sprache / Lang.		Blatt / Sh.
	Einbauanweisung ZVB14/20-B16 INSTALLATION INSTRUCTION		de en	01.00	4
ZVB		Datum Date	2007-02-19	Abteilung Dept.	1ESK
		Name Name	Wn	Zeichn.Nr. / Drawing No.	
				1164.1257.00	



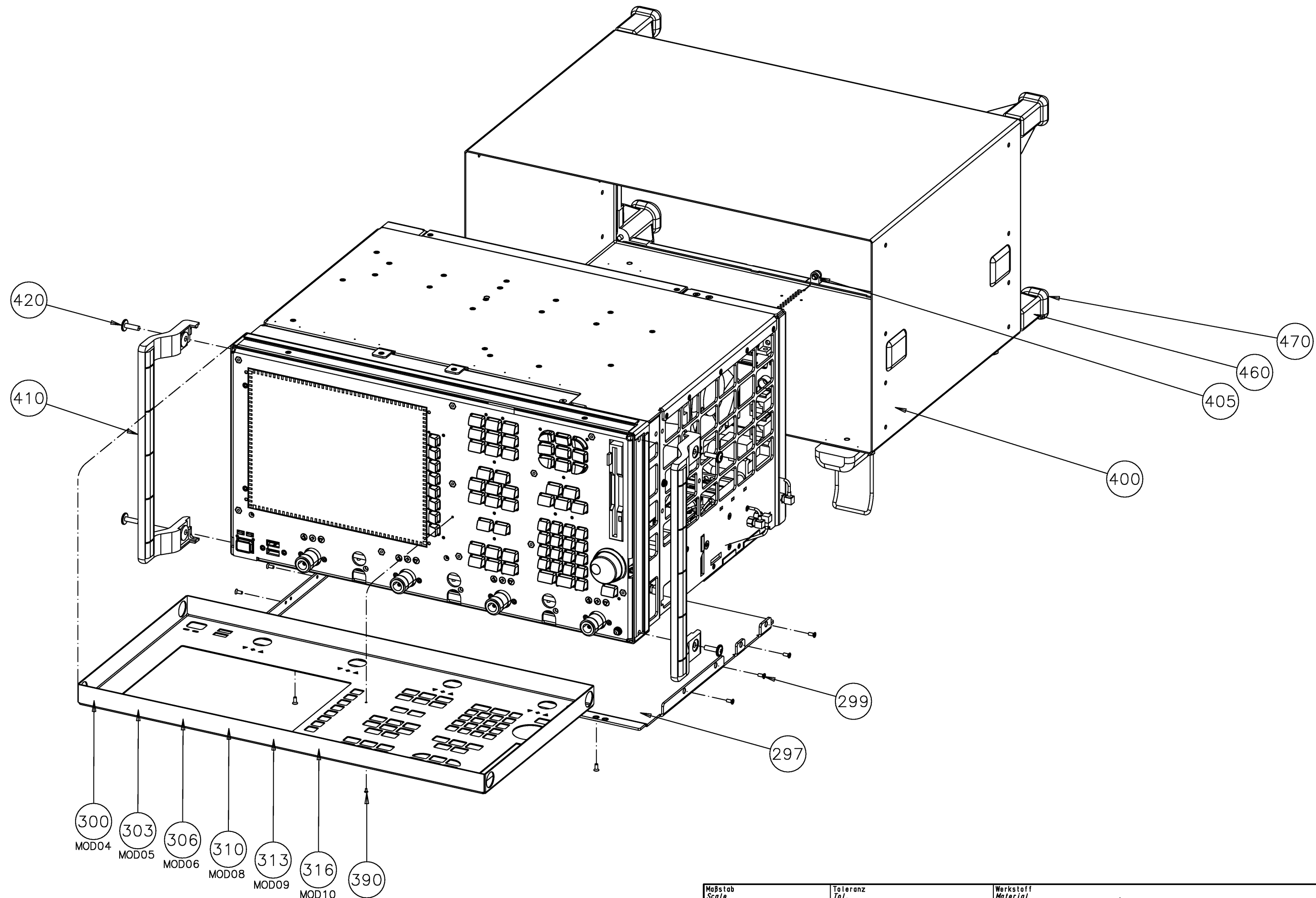
Für dieses Dokument behalten wir uns alle Rechte vor
For this document all rights are reserved

Projektions-
methode
Projection
Method

Maßstab Scale	Toleranz Tol.		Werkstoff Material		Benennung / Designation		Sprache / Lang.	Aei. / C.I.	Blatt / Sh.
ROHDE&SCHWARZ	ZVB		Einbauanweisung ZVB14/20-B16 INSTALLATION INSTRUCTION		Datum Date		de en	01.00	5
					Abteilung Dept.		Name Name		Zeichn.Nr. / Drawing No.
					2007-02-19		1ESK Wn		1164.1257.00 D

Für dieses Dokument behalten wir uns alle Rechte vor
For this document all rights are reserved

Projektions-
methode
Projection
Method



Maßstab Scale	Toleranz Tol.	Werkstoff Material	Sprache / Lang. Ael. / C.I.			Blatt / Sh.
ROHDE&SCHWARZ	Benennung / Designation	en 01.00 1			Zeichn.Nr. / Drawing No.	
ZVB8-B2X	Datum Date	2006-06-19	Abteilung Dept.	1ESK	Name Name	Wn
EINBAUANWEISUNG ZVB8-B2X INSTALLATION INSTRUCTION ZVB8-B2X			1302.5980.00 D			

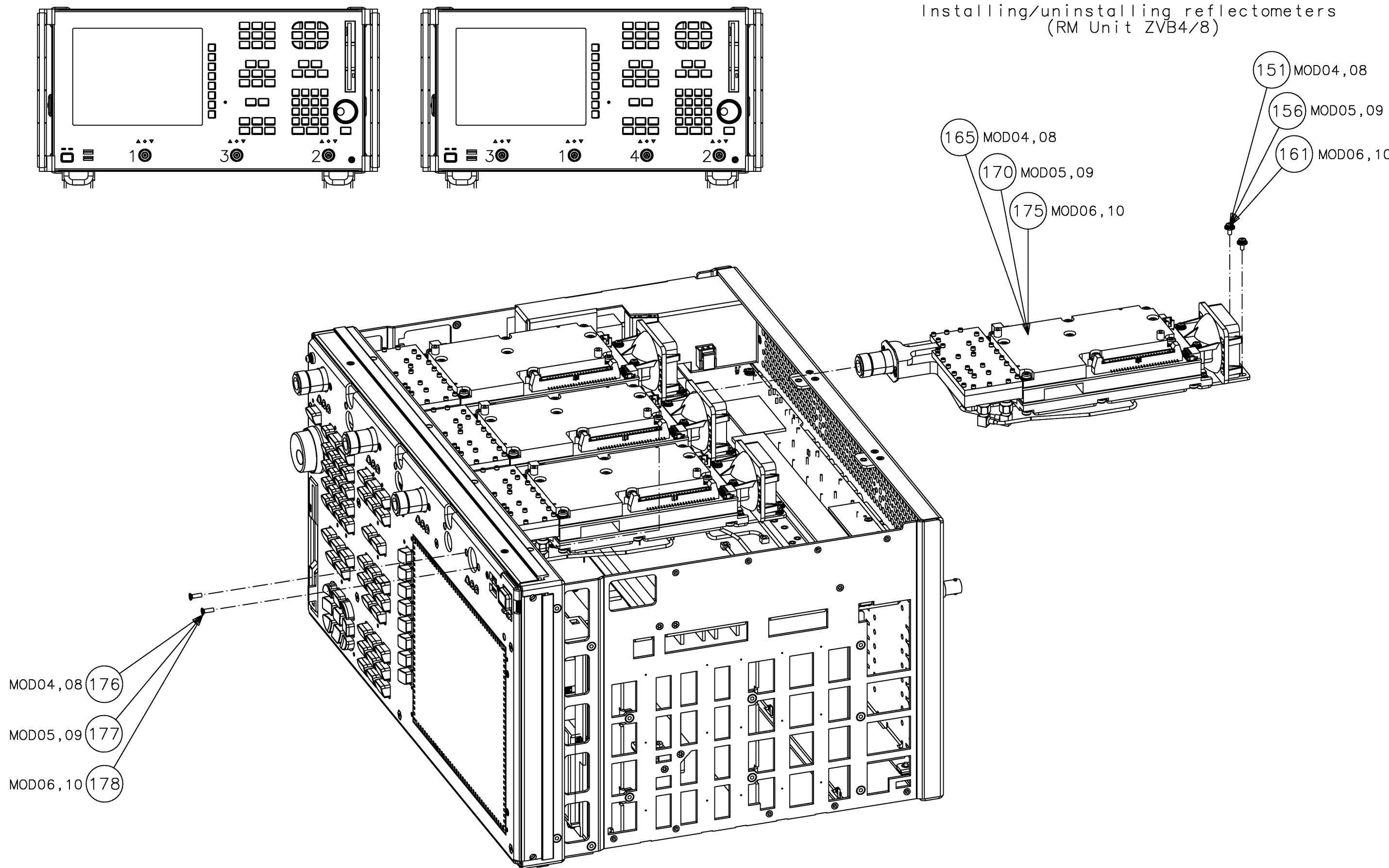
Für dieses Dokument behalten wir uns alle Rechte vor
For this document all rights are reserved

Projektions-
methode
Projection
Method

ZVB4/8 - 2/3PORT

ZVB4/8 - 4PORT

Installing/uninstalling reflectometers
(RM Unit ZVB4/8)



Maßstab Scale	Toleranz Tol.	Werkstoff Material	Benennung / Designation			Sprache / Lang.	Äd. / C.I.	Blatt / Sh.
ROHDE&SCHWARZ			EINBAUANWEISUNG ZVB8-B2X INSTALLATION INSTRUCTION ZVB8-B2X			en	01.00	2
ZVB8-B2X	Datum Date	2006-06-19	Abteilung Dept.	1ESK	Name Name	Wn	Zeichn.Nr. / Drawing No. 1302.5980.00	

Für dieses Dokument behalten wir uns alle Rechte vor
For this document all rights are reserved

Projektions-
methode
Projection
Method

I

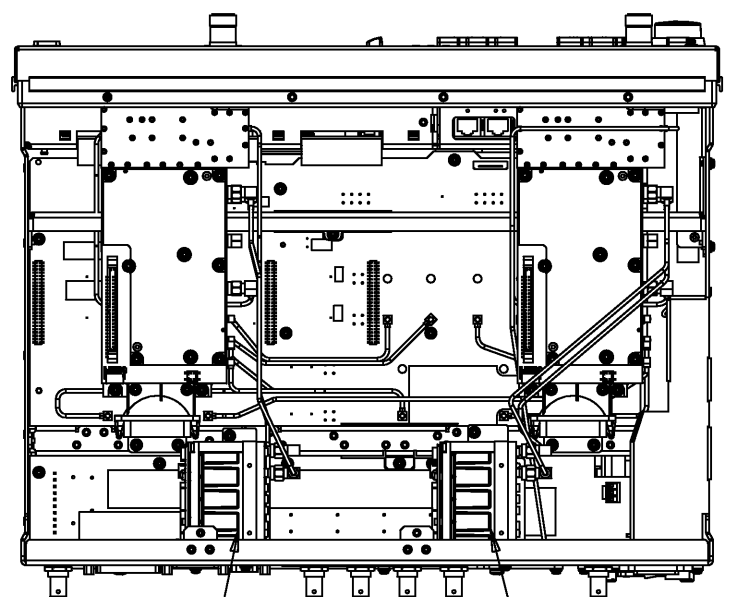
C

D

E

F

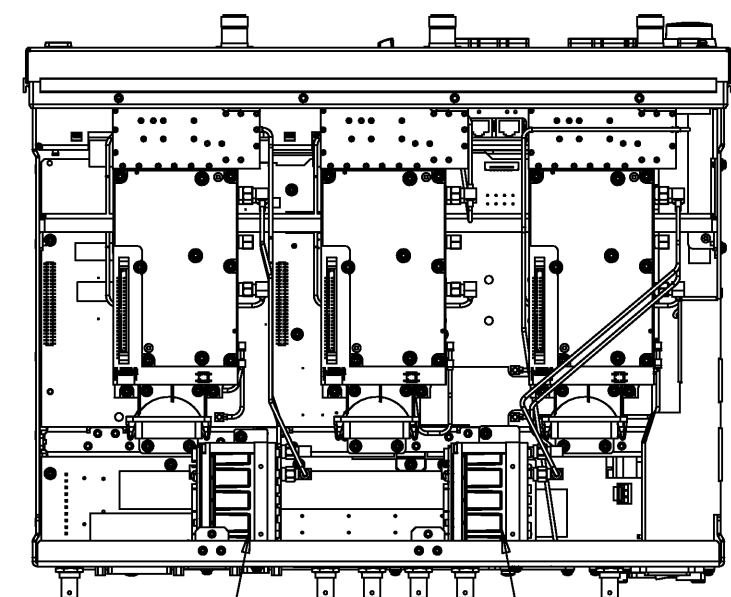
ZVB4/8 2Port with ZVB8-B21 and ZVB8-B22



ZVB8-B21 ZVB8-B22

Possible Options:
ZVB8-B21
ZVB8-B22
ZVB8-B21 and ZVB8-B22

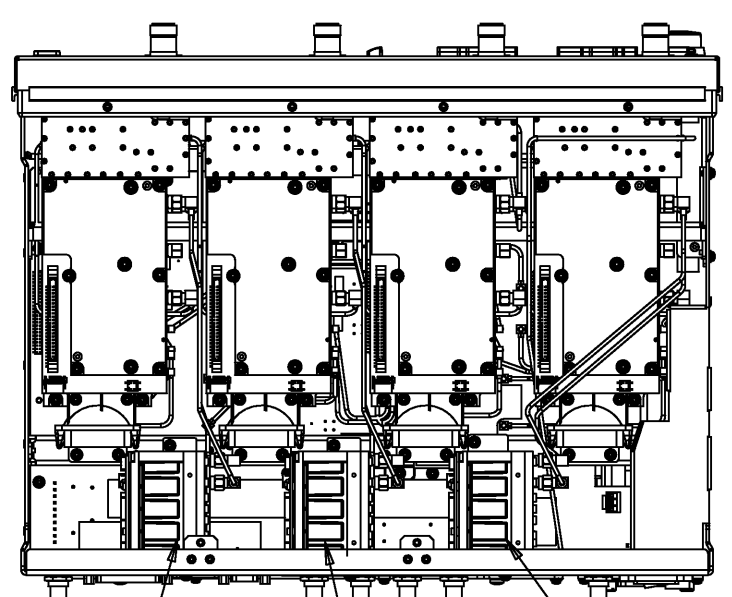
ZVB4/8 3Port with ZVB8-B21 and ZVB8-B22



ZVB8-B21 ZVB8-B22

Possible Options:
ZVB8-B21
ZVB8-B22
ZVB8-B21 and ZVB8-B22

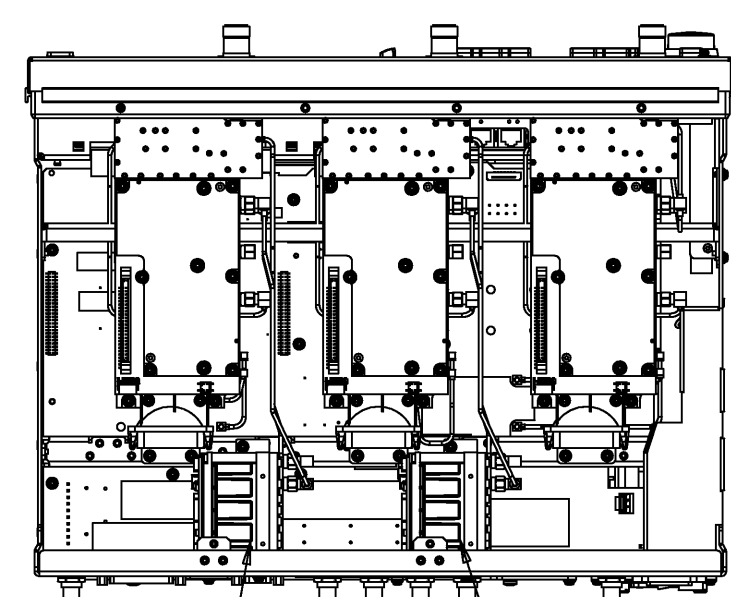
ZVB4/8 4Port with ZVB8-B21, ZVB8-B22 and ZVB8-B23



ZVB8-B23 ZVB8-B21 ZVB8-B22

Possible Options:
ZVB8-B21
ZVB8-B22
ZVB8-B23
ZVB8-B21 and ZVB8-B22
ZVB8-B21 and ZVB8-B23
ZVB8-B22 and ZVB8-B23
ZVB8-B21 and ZVB8-B22 and ZVB8-B23

ZVB4/8 3Port with ZVB8-B21 and ZVB8-B23



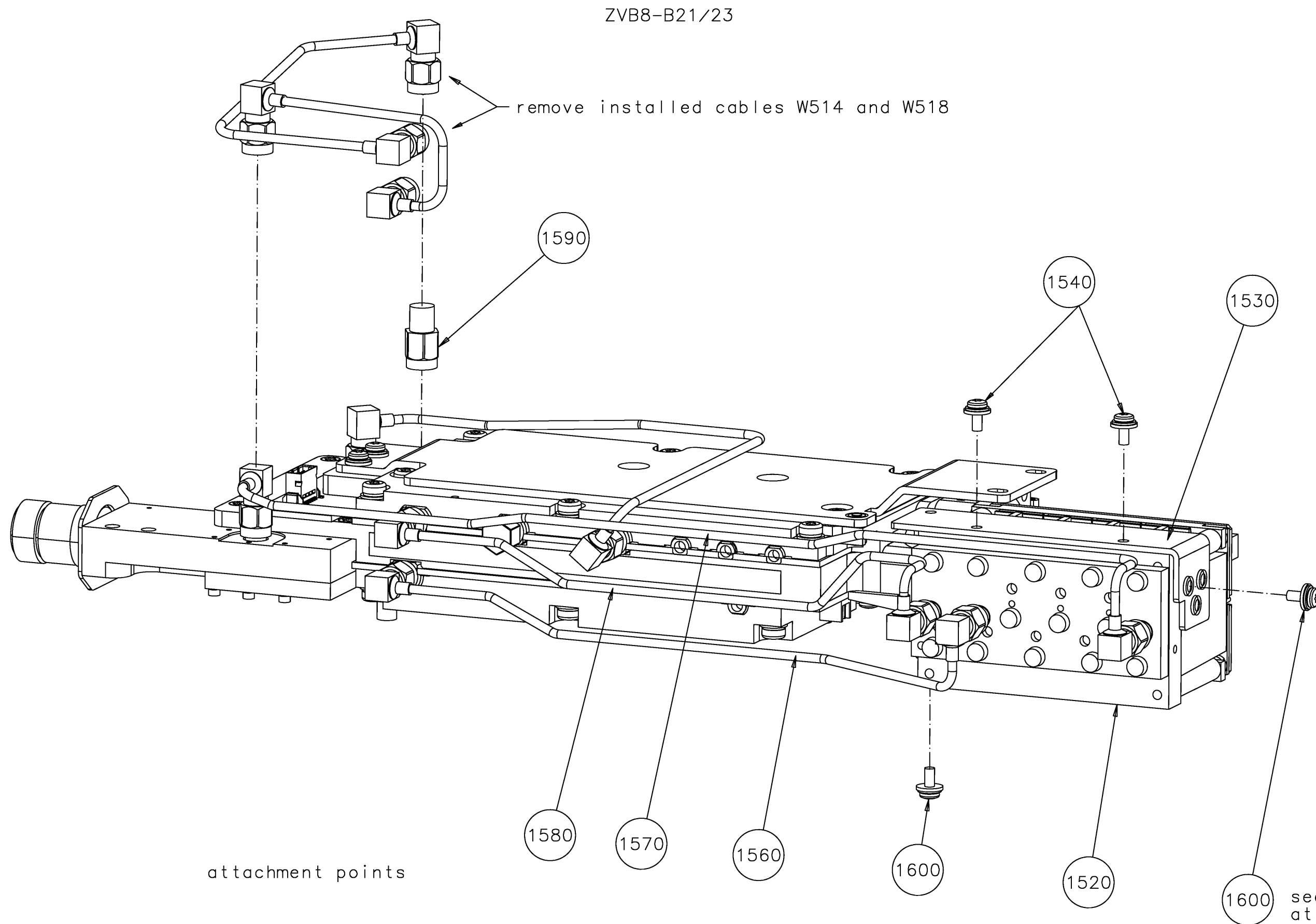
ZVB8-B21 ZVB8-B23

Possible Options:
ZVB8-B21
ZVB8-B23
ZVB8-B21 and ZVB8-B23

Maßstab Scale	Toleranz Tol.	Werkstoff Material						
ROHDE&SCHWARZ	Benennung / Designation EINBAUANWEISUNG ZVB8-B2X INSTALLATION INSTRUCTION ZVB8-B2X					Sprache / Lang.	Äsl. / C.I.	Blatt / Sh.
						en	01.00	3
ZVB8-B2X	Datum Date	2006-06-20	Abteilung Dept.	1ESK	Name Name	Wn		
						Zeichn.Nr. / Drawing No. 1302.5980.00		
						D		

Für dieses Dokument behalten wir uns alle Rechte vor
For this document all rights are reserved

Projektions-
methode
Projection
Method



for ZVB8-B21 2PORT
ZVB8-B21 3PORT
ZVB8-B23 4PORT

for ZVB8-B21 4PORT

for ZVB8-B23 3PORT

Pos. 1550 not shown

see detail
attachment points

Maßstab Scale	Toleranz Tol.	Werkstoff Material	Sprache / Lang. Ael. / C.I.			Blatt / Sh.
ROHDE&SCHWARZ	Benennung / Designation	EINBAUANWEISUNG ZVB8-B2X INSTALLATION INSTRUCTION ZVB8-B2X		en	01.00	4
ZVB8-B2X	Datum Date	2006-06-21	Abteilung Dept.	1ESK	Name Name	Wn
			Zeichn.Nr. / Drawing No.			1302.5980.00 D

Für dieses Dokument behalten wir uns alle Rechte vor
For this document all rights are reserved

Projektions-
methode
Projection
Method

ZVB8-B22

remove installed cables W514 and W518

see detail
attachment points

attachment points

for ZVB8-B22 2PORT
ZVB8-B22 3PORT

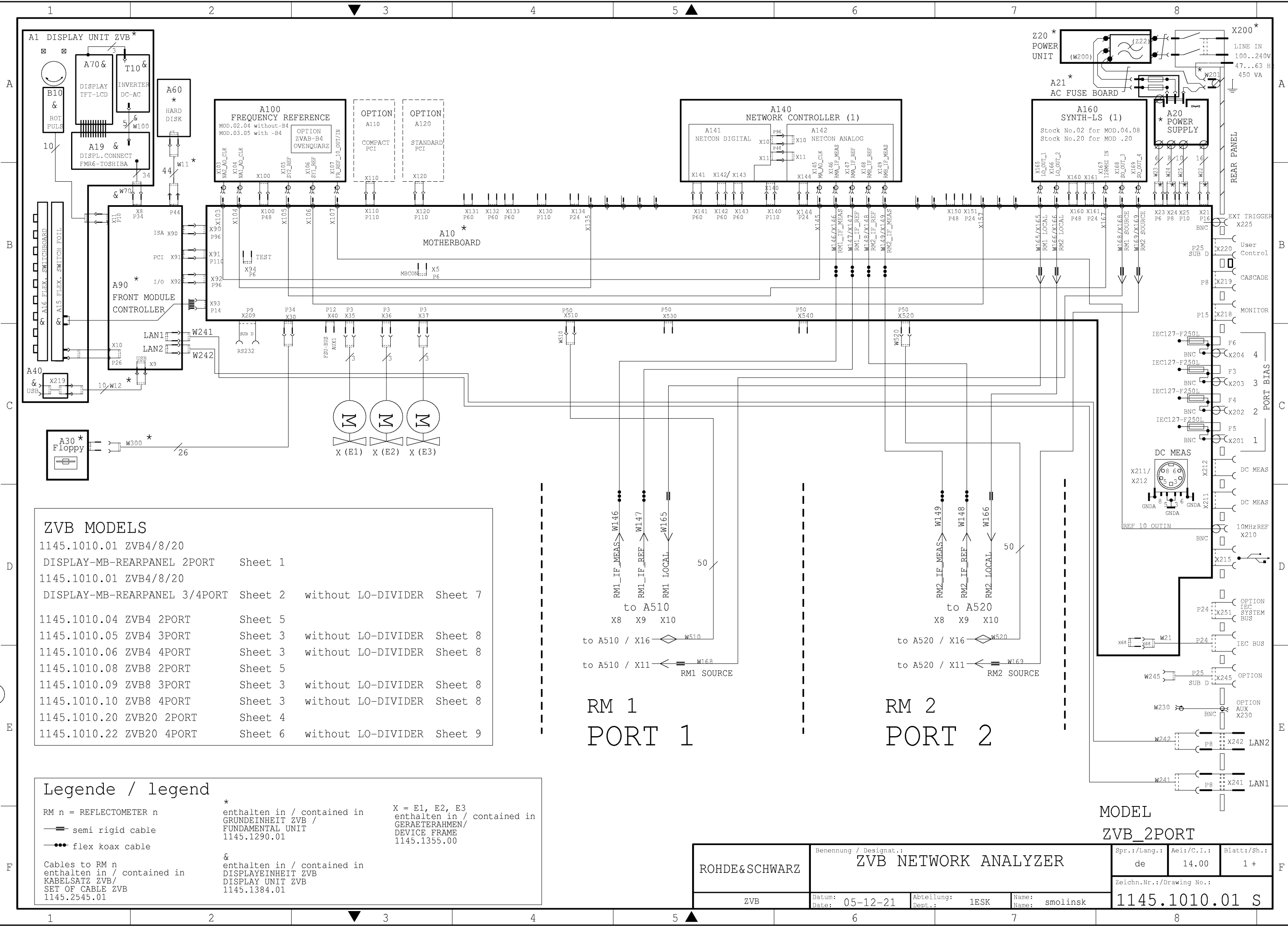
for ZVB8-B22 4PORT

Pos. 1550 not shown

Maßstab Scale	Toleranz Tol.	Werkstoff Material	Sprache / Lang. Ael. / C.I.			Blatt / Sh.
ROHDE&SCHWARZ	Benennung / Designation	EINBAUANWEISUNG ZVB8-B2X INSTALLATION INSTRUCTION ZVB8-B2X			en	01.00
ZVB8-B2X	Datum Date	2006-06-21	Abteilung Dept.	1ESK	Name Name	Wn
			Zeichn.Nr. / Drawing No.			1302.5980.00
			D			

Block Circuit Diagram

Fuer dieses Dokument behalten wir uns alle Rechte vor
For this document all rights are reserved



ZVB MODELS			
1145.1010.01 ZVB4/8/20	DISPLAY-MB-REARPANEL 2PORT	Sheet 1	
1145.1010.01 ZVB4/8/20	DISPLAY-MB-REARPANEL 3/4PORT	Sheet 2	without LO-DIVIDER Sheet 7
1145.1010.04 ZVB4 2PORT		Sheet 5	
1145.1010.05 ZVB4 3PORT		Sheet 3	without LO-DIVIDER Sheet 8
1145.1010.06 ZVB4 4PORT		Sheet 3	without LO-DIVIDER Sheet 8
1145.1010.08 ZVB8 2PORT		Sheet 5	
1145.1010.09 ZVB8 3PORT		Sheet 3	without LO-DIVIDER Sheet 8
1145.1010.10 ZVB8 4PORT		Sheet 3	without LO-DIVIDER Sheet 8
1145.1010.20 ZVB20 2PORT		Sheet 4	
1145.1010.22 ZVB20 4PORT		Sheet 6	without LO-DIVIDER Sheet 9

Legende / legend

RM n = REFLECTOMETER n

— semi rigid cable

... flex koax cable

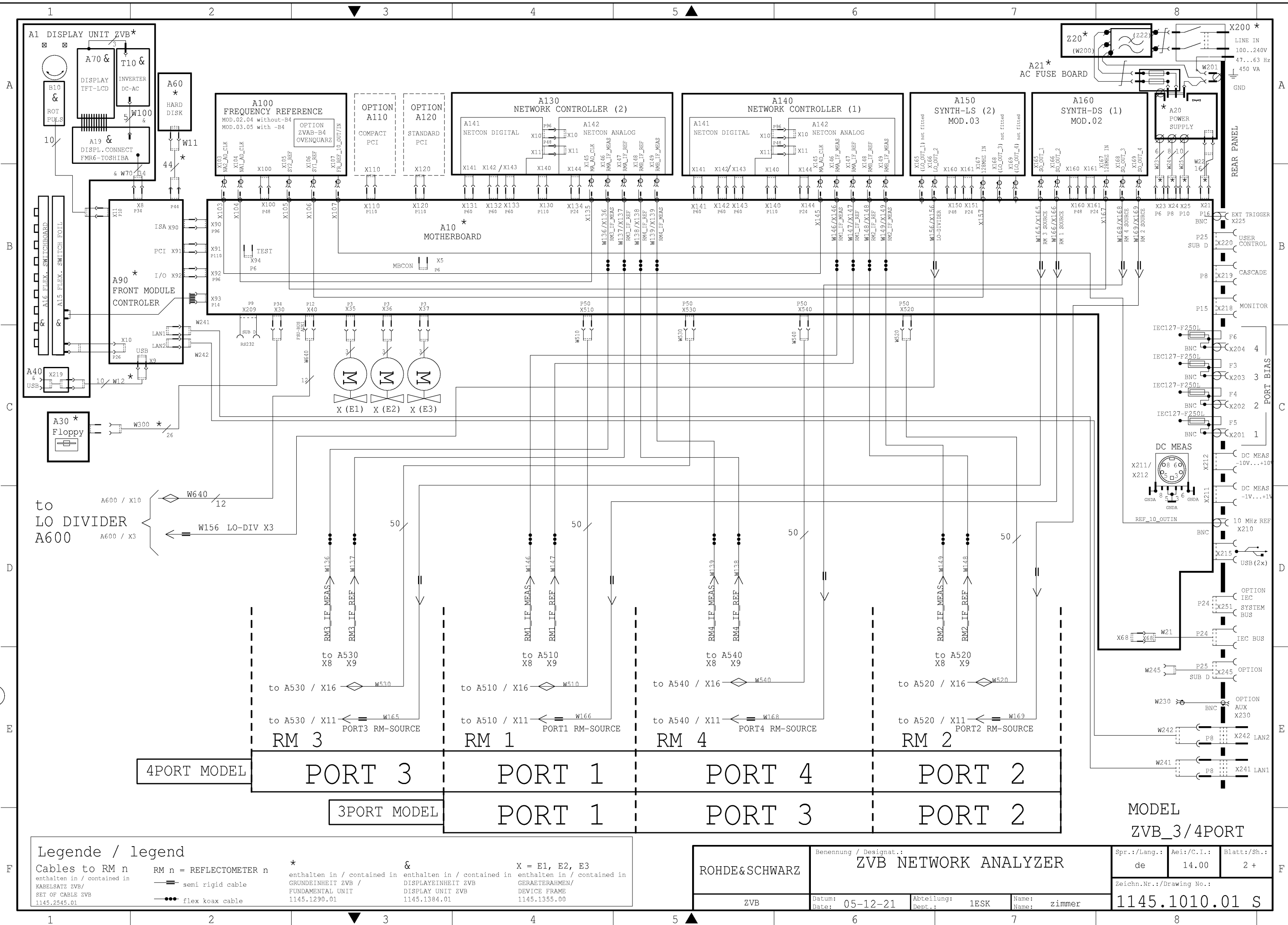
Cables to RM n
enthalten in / contained in
KABELSATZ ZVB/
SET OF CABLE ZVB
1145.2545.01

*
enthalten in / contained in
GRUNDEINHEIT ZVB /
FUNDAMENTAL UNIT
1145.1290.01

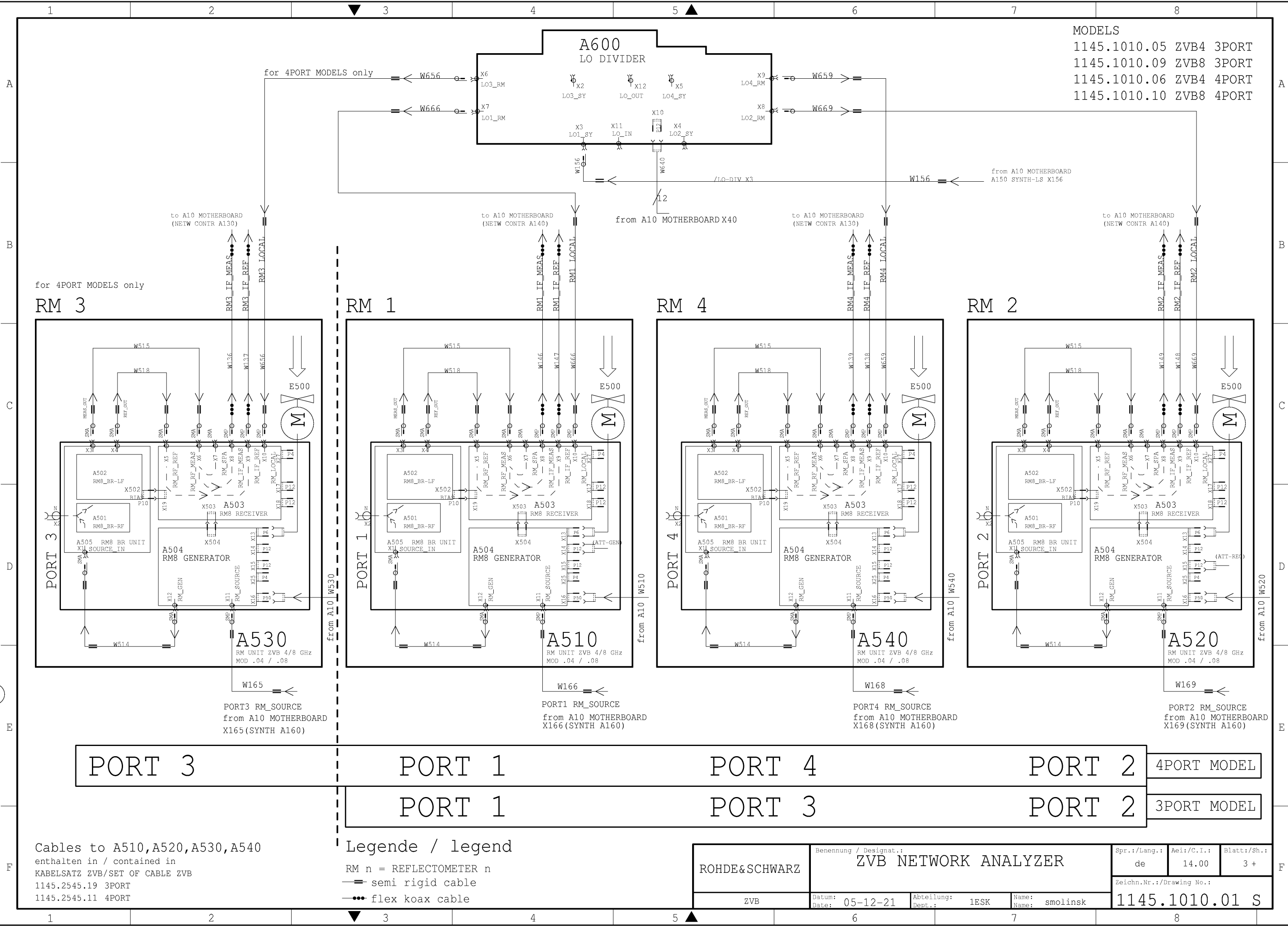
&
enthalten in / contained in
DISPLAYEINHEIT ZVB
DISPLAY UNIT ZVB
1145.1384.01

X = E1, E2, E3
enthalten in / contained in
GERÄTERAHMEN/
DEVICE FRAME
1145.1355.00

ROHDE&SCHWARZ	Benennung / Designat.: ZVB NETWORK ANALYZER			Spr.:/Lang.: de	Aei:/C.I.: 14.00	Blatt:/Sh.: 1 +
	Datum: Date: 05-12-21	Abteilung: Dept.: 1ESK	Name: Name: smolinsk	Zeichn.Nr.:/Drawing No.: 1145.1010.01 S		



Fuer dieses Dokument behalten wir uns alle Rechte vor
For this document all rights are reserved



①



E

F

Ext Cables to A510,A520
enthalten in / contained in
KABELSATZ ZVB/SET OF CABLE ZVB
1145.2545.22



F

Spr.:/Lang.:	Aei:/C.I.:	Blatt:/Sh.:
de	14.00	4 +
Zeichn.Nr.:/Drawing No.:		

ROHDE&SCHWARZ	Benennung / Designat.: ZVB NETWORK ANALYZER			Spr.:/Lang.: de	Ael.:/C.I.: 14.00	Blatt:/Sh.: 4 +
				Zeichn.Nr.:/Drawing No.: 1145.1010.01 S		
ZVB	Datum: Date: 05-12-21	Abteilung: Dept.: 1ESK	Name: Name: smolinsk			

Fuer dieses Dokument behalten wir uns alle Rechte vor
For this document all rights are reserved

E

Legende / legend

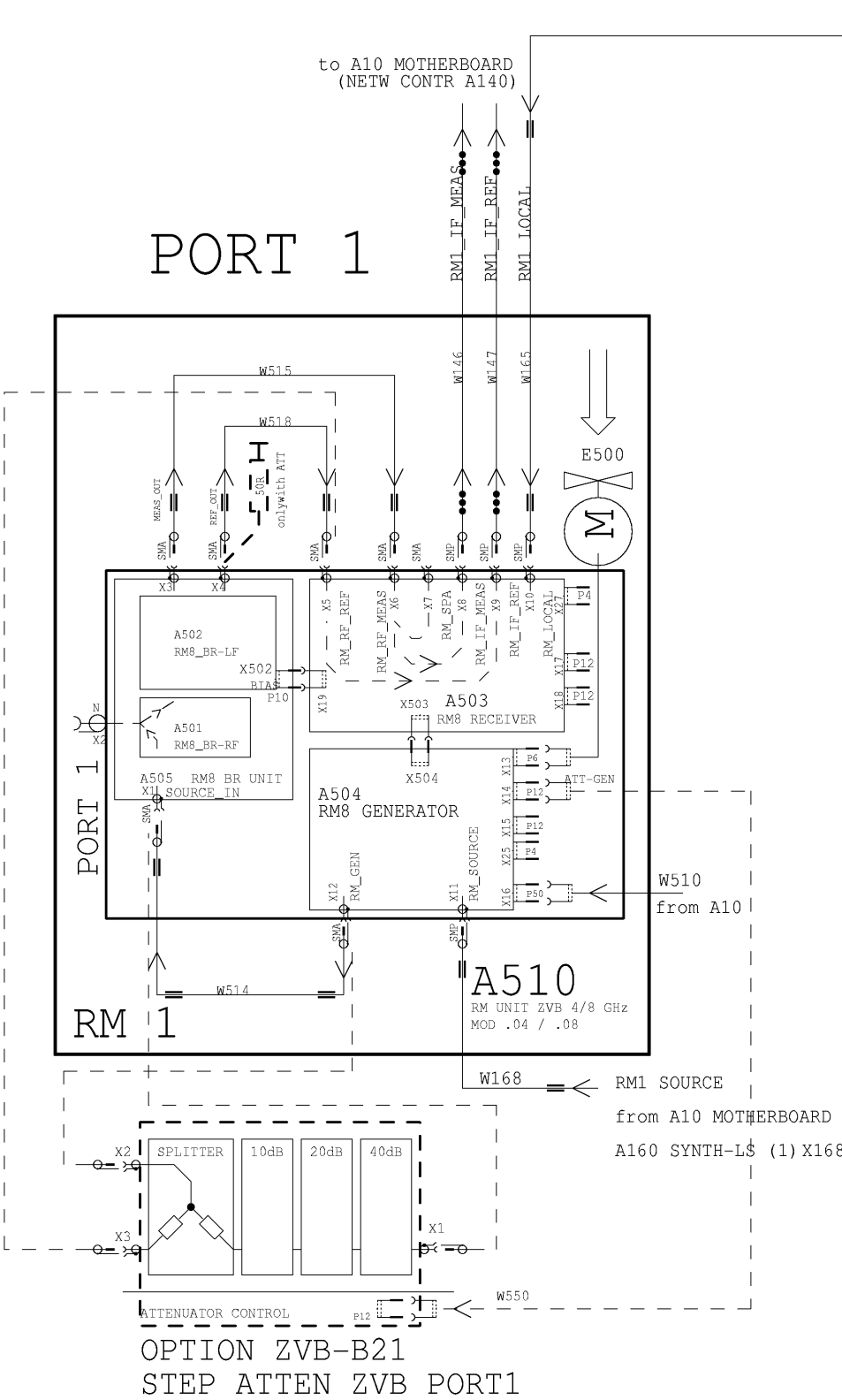
RM n = REFLECTOMETER n

— semi rigid cable
— flex koax cable

Ext Cables to A510, A520
enthalten in / contained in
KABELSATZ ZVB/SET OF CABLE ZVB
1145.2545.08

MODELS
1145.1010.04 ZVB4 2PORT
1145.1010.08 ZVB8 2PORT

ROHDE&SCHWARZ	Benennung / Designat.: ZVB NETWORK ANALYZER			Spr.:/Lang.: de	Aei:/C.I.: 14.00	Blatt:/Sh.: 5 +
	ZVB	Datum: Date: 05-12-21	Abteilung: Dept.: 1ESK	Name: Name: smolinsk	1145.1010.01 S	



F



ROHDE & SCHWARZ

Spr.:/Lang.:	Aei:/C.I.:	Blatt:/Sh.:
de	14.00	6 +
Zeichn.Nr.:/Drawing No.:		
1145.1010.01 S		

Ⓔ



PORT 2

A160 SYNTH-DS



F

ROHDE&SCHWARZ	Benennung / Designat.: ZVB NETWORK ANALYZER			Spr.:/Lang.: de	Aei:/C.I.: 14.00	Blatt:/Sh.: 9 -
				Zeichn.Nr.:/Drawing No.: 1145.1010.01 S		
ZVB	Datum: Date.: 05-12-21	Abteilung: Dept.: 1ESK	Name: Name: smolinsk			

Fuer dieses Dokument behalten wir uns alle Rechte vor
For this document all rights are reserved

(E)

SOURCE_IN
X1
SMA (f)

Zeichenerklaerung / legend

— 50 Ohm

X2
PORT 1
N (f)

Bindende Angaben ueber Varianten,
Trimmwerte, Bauteile und
nicht bestueckte Bauteile siehe ST.
For binding information on models,
trimming and components values and
nonfitted components see parts list.



ACHTUNG: ESD!
Elektrostatisch gefaehrdete
Bauelemente erfordern eine
besondere Handhabung.
ATTENTION: ESD!
Electrostatic sensitiv devices
require a special handling.

ROHDE&SCHWARZ

ZVAB

Benennung / Designat.:
RM8 BR UNIT
RM8 BR UNIT

Datum:
Date: 05-09-01

Abteilung:
Dept.: 1ESK

Name:
Name: smolinsk

Spr.:/Lang.: de	Aei:/C.I.: 17.00	Blatt:/Sh.: 1 -
Zeichn.Nr./Drawing No.: 1145.3593.01 S		

VARIANTENERKLAERUNG/
EXPLANATION OF MODELS

MOD .02 = BASIC MODEL
MOD .03 = without LF and REF
= MOD .03 not fitted

A501
BR SUBSTRAT 8GHZ

W2 #
CABLE 2

W1
CABLE 1

W0
CABLE 0

REF LF AMP

A502

RM8 BR-LF_FILT
VAR/MOD .02 = BASIC MODEL
* = VAR/MOD .02 not fitted
VAR/MOD.03 = without LF and REF
= VAR/MOD .03 not fitted

MEAS LF AMP

BIAS LP FILTER

X4 #
REF_OUT
SMA (f)

X3
MEAS_OUT
SMA (f)

Z3 #
Z2 #
Z1 #